Georgia Ports Authority

Savannah Harbor Expansion Feasibility Study Report

Main Report

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July 1998

SAVANNAH HARBOR EXPANSION FEASIBILITY REPORT

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3. EXECUTIVE SUMMARY

3.1. Problems and Opportunities

The Georgia Ports Authority conducted a feasibility study to determine if improvements at Savannah Harbor, Georgia, are justified. This study was conducted under the authority of Section 203 of the Water Resources Development Act of 1986. This legislation allows non-Federal interests to fund and conduct feasibility studies of proposed harbor modifications. However, Section 203 studies must meet all applicable Federal requirements for a harbor improvement feasibility study. In this regard, the U.S. Army Corps of Engineers, Savannah District, provided technical support and policy review of the draft documents. The Georgia Ports Authority prepared this Feasibility Report for submittal to the Assistant Secretary of the Army for Civil Works to be considered for authorization in the 1998 Water Resources Development Act.

The Port of Savannah is presently constrained by existing channel depths and other harbor features. The currently authorized project depths are 42 feet in the inner harbor, 42 feet in the entrance channel (Stations 0+000 to –14+000B), and 44 feet in the entrance channel (Stations –14+000B to –60+000B). Container traffic during the first half of this decade greatly exceeded projections. In order for the Port to continue its growth, it must remain efficient and cost competitive with other ports. The world fleet is projected to increase in vessel size and the Port of Savannah is expected to capture a significant portion of the world fleet. Increased channel depths are necessary to accommodate the increasing drafts of these larger vessels.

At the onset, it was apparent that the growth of container ship in size, particularly depth, had outstripped the projections made during the last expansion. This, coupled with the short time available until passage of WRDA 1998, led to a scoping guideline being chosen which took full benefit of the flexibility provided under National Environmental Policy Act (NEPA). Specifically provided for is the ability to conduct a Tier I EIS consistent with the decision to be taken in order to avoid delay with provision for a Tier II EIS for the mitigation plan itself. Since the first decision was the feasibility of the project, a "worst case" impact was selected with the final mitigation plan being tiered upon this selection.

The study initially considered a 50-foot maximum practicable depth for harbor expansion. The engineering, economic, real estate and environmental analyses initially used this 50-foot depth as a maximum probable depth.

3.2. Plan Formulation

The plan formulation process considered four initial harbor expansion alternatives (44', 46', 48' and 50' depths in the inner harbor). Similar to existing conditions, for each alternative the channel would be 2 feet deeper in the entrance channel from Stations –14+000B to deepwater. All of the initial alternatives included additional harbor

improvements, including enlarging Kings Island Turning Basin and constructing wideners. The current location and depth of advance maintenance in the harbor channel would be preserved.

The economic analysis evaluated current port conditions with existing channel depths and other features. An economic study investigated future trade forecasts and fleet forecasts to determine the size of vessels that could be expected to utilize the Port of Savannah. For the current harbor conditions and all harbor expansion alternatives, the operating costs, tidal delay costs, and beam width delay costs were computed. The preliminary benefits for each initial alternative were the difference in total navigation costs between the current base condition and each alternative.

An engineering analysis was conducted for current harbor conditions and any improvements required for the harbor expansion alternatives. Preliminary costs were developed for these improvements. Based upon preliminary benefits, costs, and impacts of the initial alternatives, four final harbor expansion alternatives (46', 47', 48', 50') were selected for more detailed evaluation. Economic benefits were refined to provide more detailed projections of future conditions. Detailed cost estimates using the MicroComputer Aided Cost Engineering System (MCACES) and Cost Engineering Dredge Estimating Program (CEDEP) were developed for each of the final alternatives.

3.3. Recommended Plan

Federal regulations require that the plan selected for Federal action must be the National Economic Development (NED) Plan. However, the Locally Preferred Plan, and Recommended Plan, can be a project larger or smaller than the NED Plan if there are overriding and compelling reasons for selecting a different plan. The resultant benefit/cost analysis of the final alternatives indicated Alternative 48 was the NED Plan. The Georgia Ports Authority considered the additional benefits of a deeper channel and their projected port growth and initially selected Alternative 50 (50-foot channel in the inner harbor) as the Locally Preferred Plan. However, the economic and environmental costs of this plan were reconsidered in light of the feedback received during the public comment period. This resulted in the selection of 48 ft. as the Locally Preferred Plan. Consequently, the NED plan and the Locally Preferred Plan are the same. The Recommended Plan is the 48 ft. alternative

3.4. Impacts Of Recommended Plan

A Draft Tier I Environmental Impact Statement (EIS) was prepared. The Draft Final Tier I EIS included water quality modeling of existing harbor conditions and the 50-foot maximum probable expansion project. This document concluded that implementation of the Recommended Plan or any of the harbor expansion alternatives would have impacts to cultural resources and natural resources in the harbor and adjacent areas. Preliminary data indicated six areas that might be affected by implementation of a harbor expansion project:

- Any channel deepening would affect the stability of the structure at Old Fort Jackson, a National Historic site, and require protection of the site.
- Any channel deepening would require excavation and recovery of the CSS Georgia, a Civil War vessel sunk in the river channel.
- Channel deepening would result in increased salinity levels and decreased dissolved oxygen levels in the river and adjacent to the Savannah National Wildlife Refuge. These would cause:
  - Conversion of 1170 acres classified as freshwater wetlands to saltwater wetlands.
  - Changes in shortnose sturgeon nursery habitat.
- Loss of approximately 10 acres of saltwater wetlands.
- Increased salinity could impact the striped bass spawning area in Middle and Back Rivers.
- Chloride levels could increase at the city of Savannah water intake on a tributary of the Savannah River located approximately 8 miles upstream of the harbor project limits.

3.5. Preliminary Mitigation And Impact Avoidance Plans

Several impact avoidance and mitigation actions were developed to address these cultural and natural resource concerns. The Recommended Plan includes features and costs for the following actions:

- A Cultural Resources Mitigation Plan which includes protection of Old Fort Jackson and recovery of the CSS Georgia.
- A Natural Resources Mitigation Plan which includes:

  1) Purchase of 3,000 acres of freshwater wetlands in the upper harbor basin.

  2) Creation of 80.5 acres of new saltwater marsh.

  3) Dredging of the Port Wentworth Turning Basin by 8 feet to improve habitat for shortnose sturgeon and the conduct of a study of shortnose sturgeon behavior.
- A Striped Bass Impact Avoidance Plan which includes closing selected channels connecting the Savannah River and Middle River and opening a cut from Middle River to Back River. The goal is to prevent salinity from entering the Savannah National Wildlife Refuge and

3.6. Benefits and Costs of the Recommended Plan

The Recommended Plan includes:

- Dredging the inner harbor to a project depth of –50 feet MLW

- Dredging the entrance channel to a project depth of –50 feet MLW from Stations 0+000 to –14+000B
- Dredging the entrance channel to –52 feet MLW from Stations –14+000B to –85+000B, plus other harbor improvements.

The plan has a total project cost of $228,517,000, including cultural resources mitigation, and an equivalent average annual cost of $17,126,535. The project would produce estimated average annual benefits of $52,742,579, which results in a benefit/cost ratio of 2.94 and $34,817,044 in net benefits. Using applicable Federal guidelines for cost sharing of navigation projects, the Federal share would be $143,061,195. For a normal Federal harbor improvement project, the non-Federal sponsor, Georgia Ports Authority would be required to provide $85,455,805 cash plus all lands, easements, rights of way, and relocations.

3.7. Implementation Of Recommended Plan

The Georgia Ports Authority has elected to construct the recommended harbor expansion project under Section 204 of the Water Resources Development Act of 1986. This legislation provides for reimbursement of the Federal share of the project, subject to project authorization and Federal appropriations. Construction is scheduled to commence in the fall of 2001 and complete in the year 2005.

4. INTRODUCTION

The Georgia Ports Authority has prepared this Feasibility Report that evaluates the feasibility of deepening a portion of Savannah Harbor, Georgia, to better serve the economic interests of both the state of Georgia and the entire Nation. This report and supporting documents will be submitted to Headquarters, U.S. Army Corps of Engineers, for consideration for inclusion in the Water Resources Development Act of 1998. The Assistant Secretary of the Army for Civil Works, ASA (CW), would then review the study findings and make a recommendation to the U.S. Congress concerning authorization of the proposed project.

Section 203 of the Water Resources Development Act of 1986 allows for non-Federal interests, such as port authorities, to fund and conduct feasibility studies of proposed harbor modifications. One of the provisions of the Section 203 process is that the study must meet all applicable Federal regulations, standards, and criteria, including full compliance with the National Environmental Policy Act (NEPA).

Section 204 of the Water Resources Development Act of 1986 further provides that the local sponsor can construct the authorized project and be reimbursed for the Federal share of project costs, subject to Federal appropriation.

4.1. Study Authority

This study has been conducted under authority provided by the Congress of the United States pursuant to the Water Resources Development Act of 1986 (Public Law 99-662) which reads as follows:

SEC.203 STUDIES OF PROJECTS BY NON-FEDERAL INTERESTS

a) *Submission to Secretary (of the Army) -- A non-Federal interest may on its own undertake a Feasibility Study of a proposed harbor or inland harbor project and submit it to the Secretary. To assist non-Federal interests, the Secretary shall, as soon as practicable, promulgate guidelines for studies of harbors or inland harbors to provide sufficient information for the formulation of studies.*

b) *Review by Secretary -- The Secretary shall review each study submitted under subsection (a) for the purpose of determining whether or not such study and the process under which such study was developed comply with Federal laws and regulations applicable to Feasibility Studies of navigation projects for harbors or inland harbors.*

c) *Submission to Congress -- Not later than 180 days after receiving any study submitted under subsection (a), the Secretary shall transmit to the Congress, in writing, the results of such review and recommendations the Secretary may have concerning the project described in such plan and design.*

d) *Credit and Reimbursement -- If a project for which a study has been submitted under subsection (a) is authorized by any provision of Federal law enacted after the date of such submission, the Secretary shall credit toward the non-Federal share of the cost of construction of such project an amount equal to the portion of the cost of developing such study that would be the responsibility of the United States if such study were developed by the Secretary.*

4.2. Federal Interest

The Federal interest in public works for navigation is derived from the commerce clause of the U.S. Constitution and is limited to the navigable waters of the United States. Federal navigation improvements on those waters must be justified as being in the general public interest and must be open to the use of all on equal terms. Improvements such as channels, jetties, breakwaters, and maneuvering basins may be eligible for Federal participation as general navigation features of waterway projects. Facilities to accommodate vessels or load and unload cargo, such as berths and cargo handling equipment, are the responsibilities of non-Federal interests, even though such facilities may be necessary to achieve the benefits of the Federal project. The U.S. Coast Guard has responsibility for the design and construction of aids to navigation, such as buoys, ranges, lights, or channel markers.

4.3. Federal Policies And Procedures

The Assistant Secretary of the Army for Civil Works must determine whether this Feasibility Report and supporting documents comply with all pertinent Federal laws and regulations pertaining to feasibility studies of harbor navigation projects. The U.S. Army Corps of Engineers must follow administrative policies expressed in various Engineering Regulations (ERs) and other Department of the Army memoranda. The most pertinent of these regulations is ER 1105-2-100 (*Guidance for Conducting Civil Works Planning Studies)*. This regulation summarizes and interprets relevant statutes, congressional resolutions, executive directives, and other regulations regarding studies of this type and the criteria that must be applied in them.

Prospective projects must be evaluated for their economic feasibility and environmental acceptability as well as for their engineering soundness. The Water Resource Council's publication "*Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies"* is used in these evaluations. Economic feasibility is determined by evaluating the National Economic Development (NED) benefits of the project alternatives. Chapter II of the Principles and Guidelines (*National Economic Development Benefit Evaluation Procedures*) is used for this purpose. Economic feasibility is established if, within these guidelines, the NED benefits achieved by a solution fully offset the long-term costs of its implementation.

Environmental evaluation of proposed navigation improvements must follow Chapter III of the Principles and Guidelines, "*Environmental Quality (EQ) Evaluation Procedures,*" as well as other Federal, State, and local statutes and regulations. Requirements of the National Environmental Policy Act of 1969 (NEPA), as amended, prevail in these considerations. This Feasibility Report includes a Draft Environmental Impact Statement that cites the full range of other laws, regulations, and policies that apply.

4.4. Study Purpose And Scope

The purpose of the study was to determine if improvements are economically feasibly at the existing harbor at the Port of Savannah, Georgia, and also determine if such improvements are cost effective, technically possible, and environmentally acceptable. The major harbor expansion improvement that was evaluated was a deepening of the inner harbor and entrance channels plus harbor modifications that would be required in conjunction with harbor deepening. Pursuant to Section 203 of the Water Resources Development Act of 1986 and implementing guidance contained in Engineering Regulation No. 1165-2-122 dated 26 August 1991, the study also determined the extent of both Federal and non-Federal cost-sharing participation in the recommended harbor improvements.

4.5. Study Area

Savannah Harbor is a deep draft harbor on the South Atlantic coast 75 statute miles south of Charleston Harbor, South Carolina, and 120 miles north of Jacksonville Harbor, Florida. Figure 4-1 presents a location map for the study area. The harbor and deep draft navigation channel comprise the lower 21.3 miles of the Savannah River and 11.4 miles of channel across the bar to the Atlantic Ocean. The Savannah River, with certain of its tributaries, forms the boundary between the states of Georgia and South Carolina along its entire length of 313 miles.

4.6. Geography

The city of Savannah, Georgia dominates the mainland on the south side of the harbor. The city's historic downtown area is located on a south bluff approximately 18 miles above the river's mouth. Heavy industry and shipping facilities are located along the south side of the harbor upstream from the city's historic area to the upper limits of the harbor project. Additional heavy industries and a few shipping facilities line the harbor downstream from the City historic area to the Atlantic Intracoastal Waterway.

From the Intracoastal Waterway to the river's mouth, both sides of the harbor are predominantly undeveloped areas consisting of islands, marshes, dredged material disposal areas, and other undeveloped sites. Land use on the South Carolina side of the Savannah River is basically agricultural, silvicultural, with some recreation. Wetland habitat types found along Savannah Harbor include saltwater aquatic, saltwater coastal flats, saltwater marshes, freshwater aquatic, freshwater flats, and freshwater marsh.

4.6.1. Climatology

4.6.1.1 Wind

The prevailing winds are from the southwest during May to August and from the northeast during September to December. Sustained winds vary from 29 to 46 miles

per hour (mph), with gusts of 38 to 68 mph. There is about a 10 percent chance in any one year of storm winds of 74 to 95 mph..

4.6.1.2 Fog

Heavy fog can be expected about 40 days per year. Fog occurs about one to 5 days per month year-round. The heaviest fog generally occurs in November and January. Heavy fog has caused shipping delays for both inbound and outbound vessels.

4.6.1.3 Hydrology and Tides

Tidal fluctuations within Savannah Harbor are semidiurnal, averaging 6.8 feet at the mouth of the harbor and 7.9 feet at the upstream limit of the harbor; with tidal influences extending upriver approximately 45 miles. Maximum velocities encountered in the navigation channel are approximately 4 feet per second on the flood tide and 5 feet per second on ebb tide. Freshwater discharges near Clyo, Georgia (River Mile 65) average 11,600 cubic feet per second (cfs), with maximum and minimum annual mean discharges of 20,900 cfs and 9,820 cfs, respectively, since 1962. Flows in the Savannah River are regulated by three multipurpose projects including hydropower upstream. Low flows are critical because salinity moves further upstream during low flow conditions.

4.6.2. Soils

The sediments underlying the project area are largely a result of varying depositional facies. As such, the sediments are discontinuous both vertically and horizontally and numerous variations occur over short distances. Varying mixtures of poorly graded sands, silty sands, poorly graded gravels, organic silts, low liquid-limit and high liquid-limit silts, clayey sands, and low liquid-limit and high liquid-limit clays represent the uppermost sediments. Generally, soils at the river bottom exhibit lower consistency than the deeper soils. These bottom soils are often very loose and semi-liquid and can range in depth from the bottom of the river channel to only a few inches or to several feet deep. The underlying soils consist of silty sands, clayey sands, high liquid-limit silts, and low liquid-limit and high liquid-limit clays. Lenses of moderately hard to hard limestone have been encountered in borings around the project area. Its occurrence has generally been below the depths of concern for any harbor expansion project.

4.7. Port Facilities

4.7.1. Terminals and Dock Facilities

There are many private dock owners along the length of Savannah Harbor, in addition to the predominant Georgia Ports Authority (GPA) facilities. Facilities include 51 piers and wharves to serve existing waterborne commerce. With use of mooring dolphins, these piers and wharves have a combined berthing space of 30,154 feet. Various dock owners have invested large sums of money in landside infrastructure associated with the

navigation project. Features such as storage buildings, docks, and berthing areas are constructed and maintained by the dock owners.

4.7.1.1 Georgia Ports Authority Terminals

The Port of Savannah is one of the best known and highly regarded seaports in the United States. Convenient road and rail infrastructure, superior facility design, productive terminal and ship operations and a genuine commitment to service provide the framework for customers to enjoy marketplace advantage.

The Port of Savannah features two fully dedicated terminals owned and operated by the Georgia Ports Authority to accommodate any shipping requirement. Garden City Terminal (Containerport) is dedicated to container and roll on/roll off operations; while Ocean Terminal concentrates on breakbulk shipments with expansive warehousing and traditional general cargo services. In fiscal year 1997 ending June 30, a record total of 8,424,000 tons of containerized, general cargo, and bulk cargo was handled through the port, representing a 9.2 percent increase over the previous fiscal year. Of this total, 5,324,000 tons were containerized cargo, an 11.6 percent increase.

4.7.1.2 Garden City Terminal (Containerport)

The largest of Savannah's port facilities is world-class Containerport, located within the Garden City Terminal. Containerport offers more than 6,500 linear feet of docking space at six berths and inside and outside storage dedicated solely to specialized needs of high-speed container operations.

Continual upgrading of equipment and personnel has made Containerport one of the most progressive facilities of its kind in the world. Modern container cranes provide a rapid flow of containers to and from ships and sophisticated handling equipment speeds cargo to and from adjacent marshaling areas. Outside storage capacity ensures quick access to containers awaiting loading or delivery, with plenty of room for handling and maneuvering.

Counted as one of the most noteworthy improvements in service to reduce unit cost and benefit to customers at the Port of Savannah is the recent implementation of a container interchange gate system. The development of the new system, which eliminates delays for traffic being processed in or out of Containerport facilities, is credited to the corporation and assistance of labor, stevedoring companies, steamship users and the Georgia Ports Authority. Containerized cargo moves swiftly through interchange lanes to provide a decided advantage for Savannah customers.

The Port of Savannah continues to take major steps toward enhancing container handling facilities to facilitate trade and benefit customers. Work has begun on the construction of a new Container Berth Seven (CB7) to expand capacity at the Georgia Ports Authority Garden City Terminal. Scheduled for completion in the second quarter

of 1998, the addition of CB 7 will provide customers with more than 7,000 continuous feet of berthing at the Garden City Terminal.

Savannah State Docks Railroad, located at GPA's Garden City Terminal in Savannah, provides switching services seven days a week on terminal. Norfolk Southern and CSX provide interchange and line haul services.

4.7.1.3 Ocean Terminal

The 208-acre Ocean Terminal consistently ranks as the number one volume breakbulk terminal in the South Atlantic range. With over 1.5 million square feet of warehouse space plus breakbulk facilities, it efficiently handles cargo ranging from kaolin clay, granite, and forest products to iron and steel and cocoa beans.

4.7.1.4 Future Plans

The Georgia Ports Authority has a dynamic program for port expansion and improvement. The major improvements scheduled for completion or construction are:

- Completion of CB7
- Acquisition of land for Container Berth Eight (CB8)
- Construction of Container Berth Eight (CB8)
- Acquisition of two high-speed post-panamax container cranes

4.8. Study Sponsor

The feasibility study was funded in its entirety by the local sponsor, the Georgia Ports Authority, and conducted in accordance with provisions of Section 203 of the Water Resources Development Act of 1986. The Georgia Ports Authority (GPA) was created in 1945 by an act of the Georgia State legislature. GPA is an instrumentality of the state of Georgia and a public corporation existing for the express purpose of developing, maintaining and operating ocean and inland river ports within the state. While fostering international trade for state and local communities, the Georgia Ports Authority promotes Georgia's agricultural, industrial and natural resources and is dedicated to maintaining the natural quality of the environment.

The Georgia Ports Authority owns and operates the Port of Savannah, the Port of Brunswick, the Bainbridge Inland Barge Terminal and the Columbus Inland Barge Terminal. The business affairs of the Georgia Ports Authority are governed in accordance with fundamentally sound, private sector oriented management practices. Policy guidance and fiscal oversight are provided by a nine member Board of Directors appointed to serve four-year terms by the Governor from the state at large. Policy directives and administrative/managerial control measures are implemented and monitored by a chief executive officer. The Authority is financially self-sufficient; it pays all variable expenses of operation and repays principal and interest on loans with revenue generated from fees assessed for the use of facilities and for services rendered.

4.9. Roles And Responsibilities

Many different types and sizes of vessels use Savannah Harbor, although its primary use continues to be for commercial navigation. The U.S. Army Corps of Engineers and several other government entities and organizations play key roles in operating the harbor to accommodate these vessels and vital waterborne commerce. The following is a summary of just the major responsibilities as they apply to any proposed harbor expansion project.

4.9.1. U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers is responsible for the operation and maintenance of the Federal Savannah Harbor Navigation Project. In addition to operating and maintaining the Federal navigation channel, the Corps of Engineers responds to specific congressional authorization to study and implement improvements to the navigation system. In 1994, the Savannah District completed the Savannah Harbor deepening project, deepening the main navigation channel project depth from -38 to -42 feet mean low water.

4.9.2. U.S. Coast Guard

The U.S. Coast Guard is responsible for the design and location of navigation aids in the harbor. In addition, in 1993 the Coast Guard instituted new regulations for depths at berthing areas in Savannah Harbor to ensure the safety of vessels docked at the berths and reduce the chances for spilled cargoes, which could harm the environment.

4.9.3. Chatham County and Georgia Department of Transportation

Through a resolution executed by the Chatham County Commission in 1967, Chatham County serves as the non-Federal sponsor for dredged material disposal areas and berthing areas in Savannah Harbor. Its relevant responsibilities in this role are to:

- Provide without cost to the United States all lands, easements and rights-of-way required for the construction and maintenance of the project and for aids to navigation upon the request of the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of dredged material, and also necessary retaining dikes, bulkheads, and embankments therefor or the cost of such works;
- Provide and maintain at local expense depths in berthing areas commensurate with those in related project areas.

Chatham County entered into a Memorandum of Understanding with the Georgia Department of Transportation (GADOT) in 1983 for jointly fulfilling the responsibilities of the non-Federal sponsor (Chatham County) for disposal areas. Through that agreement, GADOT administers any funds appropriated by the Georgia General

Assembly for execution of the project's non-Federal responsibilities. By this agreement, the GADOT expends appropriated funds for necessary planning, construction, and maintenance tasks associated with the project.

4.9.4. Regulatory Agencies

4.9.4.1 Federal

Federal water resource development projects must be in compliance with various statutes and regulations pertaining to the protection of the environment. Under the Fish and Wildlife Coordination Act, the project must be coordinated with the USFWL, the NMFS, and state wildlife resource agencies to obtain their views on the proposed project's expected impacts on the environment. The USFWL prepares a Coordination Act Report (CAR) that includes its comments and recommendations, as well as those gathered from the state wildlife resource agencies. Federal Agencies

The U.S. Fish and Wildlife Service administers the provisions of the Fish and Wildlife Coordination Act, Endangered Species Act, and the Migratory Bird Treaty Act. All of these laws impact operations in Savannah Harbor. It also supervises and manages the two National Wildlife Refuges in the harbor area.

4.9.4.2 State

State Water Quality Certification is required from the Georgia Department of Natural Resources to ensure compliance with the state administered Section 401 Program of the Clean Water Act

The State of Georgia recently joined South Carolina in regulating the coastal areas under the Coastal Zone Management Act. Any proposed harbor expansion project would be subject to review under this act. The state of Georgia and the Advisory Council on Historic Preservation review and comment on proposed actions under the authority of Section 106 of the National Historic Preservation Act (PL 89-665) as amended. The state of Georgia owns the historic site Old Fort Jackson, which is managed by the Coastal Heritage Society. The CSS Georgia is owned by the Federal General Services Administration.

State Water Quality Certification is required from the South Carolina Department of Health and Environmental Control to ensure compliance with the state administered Section 401 Program of the Clean Water Act.

Under the Coastal Zone Management Act, any Savannah Harbor expansion project and subsequent maintenance operations are subject to the environmental conditions that will be part of the South Carolina Office of Ocean and Coastal Resources Management Consistency Certification. Historic sites are also protected by the South Carolina Historic Preservation Officer..

4.10. Prior Studies And Reports

4.10.1. Savannah Harbor Deepening Feasibility Report

In 1991, the U.S. Army Corps of Engineers, Savannah District, published the final interim feasibility study on a proposed deepening of Savannah Harbor. The study resulted in a 1994 project to deepen the inner harbor from existing 38 feet to 42 feet (Stations 103+000 to 0+000), deepen the entrance channel from existing 38 feet to 42 feet (Stations 0+000 to –14+000B), and deepen the entrance channel from existing 40 feet to 44 feet (Stations –14+000B to –60+000B). Dredged material from the entrance channel was placed at the existing ocean disposal area and, for the first time, on the beach at Tybee Island. Material from the inland channel was placed in the existing upland diked disposal areas.

4.10.2. Environmental Improvement (Section 1135) Study

The Savannah District conducted a study to evaluate proposed modifications for environmental improvements to the Savannah Harbor Navigation Project, pursuant to the authority provided by Section 1135 of the 1986 Water Resources Development Act. The approved modification closed New Cut with a hydraulic fill and ceased tide gate operation. This was intended to substantially reduce salinity levels in Back River and eliminate the flushing of striped bass eggs and larvae through New Cut to increase survival rates. A Section 1135 report, including the environmental assessment, of this proposed action was completed in September 1991. Construction was completed in April 1992 at a total cost of $2.05 million.

4.10.3. Long Term Management Strategy

In 1995, the Savannah District developed a comprehensive plan for addressing navigation and navigation related issues in Savannah Harbor. The primary focus was channel maintenance and disposal of dredged material. The EIS prepared during the study presented a new Base Plan (Federal Standard) for harbor maintenance activities, including rotational use of disposal areas. It is a comprehensive EIS for harbor operations and maintenance including Federal and local assurer responsibilities. This plan was adopted as the baseline for evaluation of the Dredged Material Management Plan needs for this project.

4.10.4. Lower Savannah River Basin Environmental Restoration Study

The Savannah District completed a final interim feasibility report in 1996 on the Lower Savannah River Basin Environmental Restoration Study. The purpose of the study was to investigate the feasibility of environmental restoration at two navigation cuts and bends on the Savannah River. The Chief of Engineers report was approved 30 June 1996 and the project was authorized for construction in the Water Resources Development Act of 1996. No construction general funds have been provided to date.

4.11. Study Participants And Coordination

This study was funded and directed by the Georgia Ports Authority, the local sponsor for the harbor expansion project. Technical studies and study management were performed by:

- Lockwood Greene Engineers, Inc.
- U.S. Army Corps of Engineer, Savannah District
- Applied Technology & Management
- Rees Engineering and Environmental Services
- Booz, Allen & Hamilton

Personnel from these six organizations formed the Study Group, which was further organized into the following groups:

- Management Group
- Vertical Team
- Technical Group
- Public Information/Involvement Group

The Environmental Impact Statement was prepared by the Georgia Ports Authority with technical assistance by personnel from the U.S. Army Corps of Engineers, Savannah District. The Savannah District also provided overview to determine that study documents and procedures were in accordance with Federal policy and guidelines.

The feasibility study observed Corps of Engineers requirements, including quality assurance in accordance with a Quality Control Plan prepared for the study. This plan included ongoing peer review of the technical studies and documents plus a detailed Independent Technical Review (ITR) of the Feasibility Report and Environmental Impact Statement.

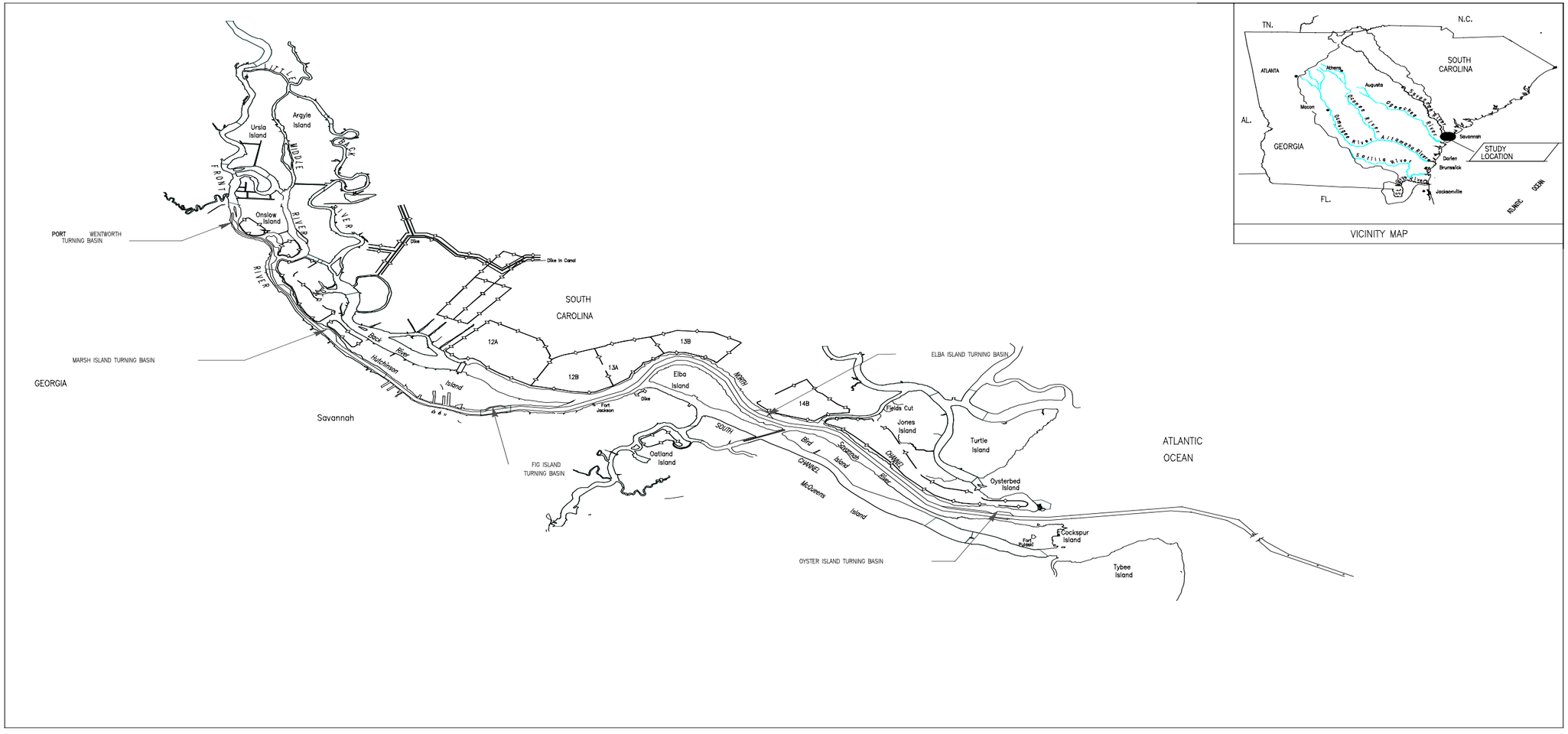
4.12. Report Contents

This Savannah Harbor Expansion Feasibility Report consists of several bound and referenced documents, including the following appendices:

- Appendix A Real Estate Appendix
- Appendix B Engineering Appendix
- Appendix C Economic Appendix

Many documents referenced in the Study Report and the Environmental Impact Statement comprise *Supplemental Documentation* which is on file and available through offices of the Savannah District and Georgia Ports Authority.

Figure 4-1 Savannah Harbor Vicinity and Features Map



5. BASELINE CONDITIONS

5.1. Federal Navigation Project

The Federal Savannah Harbor Navigation Project extends from the seaward end of the entrance channel in the Atlantic Ocean up the Savannah River to River Mile 21.3.

5.1.1. Channel Depth

As shown in Figure 5-1, the present authorized navigation channel is 32.7 miles long. The inner harbor extends 21.3 miles from the harbor entrance at Station 0+000 to the upstream project limit at Station 112+500. The entrance channel extends from Station 0+000 to Station –60+000B at natural deep water in the ocean. This feasibility study only considered harbor expansion and channel deepening to Station 103+000 (River Mile 19.5).

Figure 5-1 Savannah Harbor Navigation Project, Authorized Channel Dimensions

FEATURE	STATION	RIVER MILES	DEPTH (ft)	WIDTH (ft)
Atlantic Ocean	-60+000B	11.4B		
To		(8.7 miles)	44	600
Entrance channel	-14+000B	2.7B		
To		(2.7 miles)	42	500
Harbor Entrance	0+000	0.0		
To		(18.9 miles)	42	500
Kings Island Turning Basin	100+000	18.9		
To		(0.6 mile)	42	400
Argyle Island Turning Basin	103+000	19.5		
To		(1.6 miles)	30	200
Upstream limit of authorized project	112+500	21.1		
Total Miles		32.5 miles		

Source: Engineering Appendix.

5.1.2. Channel Location

Within the harbor limits, Savannah River is generally divided into two channels by a series of islands. From the Atlantic Ocean to River Mile 10, the harbor is separated into South and North Channels and the navigation channel is maintained in North Channel. At River Mile 10, the two channels merge to form the main Savannah River. Further upstream at River Mile 11, the river again splits into the Front and Back Rivers. The navigation channel is maintained in Front River and passes by the business district of the city of Savannah. The navigation channel is maintained in the Front River to the upper limits of the harbor at River Mile 21.3.

5.1.3. Sediment Control Works

A tide gate structure and sediment basin were constructed in 1977. To mitigate for the 1994 harbor deepening project the tide gate was taken out of service in 1990. New Cut, a channel from Middle River to Back River, was filled in 1992. The sediment basin in Back River continues to trap a significant amount of material.

5.1.4. Freshwater Control Works

Model studies for the tide gate/sediment basin project indicated the saline water would move upstream as a result of the project. To offset this, a freshwater supply system was included in the project. A canal named McCoombs Cut (also known as McCoys Cut) with 4,000 cubic feet per second design flow was constructed at River Mile 27 to provide freshwater to the impounded areas of the Refuge.

5.1.5. Turning Basins

Six authorized project turning basins are located along the navigation channel to allow ships to be turned before transiting the harbor. There also is a private turning basin at Elba Island between Oysterbed and Fig Island turning basins, which is not presently maintained.

Figure 5-2 Savannah Harbor Navigation Project, Authorized Turning Basin Dimensions

FEATURE	STATION	DEPTH (ft)	WIDTH (ft)	LENGTH (ft)
Oysterbed Island Turning Basin	3+500	40	950	1,200
Fig Island Turning Basin	68+500	34	900	1,000
Marsh Island Turning Basin	90+500	34	900	1,000
Kings Island Turning Basin	100+000	42	1,500	1,600
Argyle Island Turning Basin	103+000	30	600	600
Port Wentworth Turning Basin	110+500	30	600	600

Source: Engineering Appendix.

5.1.6. Dredged Material Disposal Areas

Approximately 7.2 million cubic yards of sediments are removed each year from the inner harbor portion of the Savannah Harbor Navigation Project by the Savannah District. The dredged material is placed in the disposal areas that have been designated for use for the project, located in Chatham County, Georgia, and Jasper County, South Carolina. Dredged material from the entrance channel is placed in an ocean disposal site that has been approved by the U.S. Environmental Protection Agency.

The non-Federal sponsor for disposal sites has provided the upland diked disposal areas for use during annual maintenance dredging in the inner harbor. The sizes of the upland disposal areas are shown in Figure 5-3.

Figure 5-3 Upland Disposal Areas

DISPOSAL AREA	LOCATION (Station)	SIZE (acres)
1N	107+500 to 112+600	130
1S		**--**
2A	93+000 to 103+000	185
12A	6+500BR to 10+100BR	1,087
12B	57+000 to 6+600BR	707
13A	47+800 to 57+000 (2+000BR)	690
13B	43+000 to 47+800	620
14A		**--**
14B	28+000 to 37+000	765
Jones/Oysterbed	0+000 to 27+000	750
Total		**4,923**

Note:

- bold – not used because areas are not diked
- "BR" indicates the stationing up Back River.

Source: Engineering Appendix.

5.1.7. Disposal Area 1N

Area 1N is the uppermost disposal area in the harbor. Area 1N will not be used for this harbor expansion project because it is normally used for maintenance dredging upstream of Station 103+000, it has a small capacity, and it contains commercial grade sand which would be covered by dredged material from the lower harbor.

5.1.8. Disposal Area 1S

Area 1S is not accessible by land and the area is not diked. Sand has been mounded in the area but has not been reused because it is not economically feasible to remove the material. Area 1S has been inactive for several years and will not be used for this harbor expansion project.

5.1.9. Disposal Area

Disposal area 2A is expected to be filled by 1999. Electric powerlines cross the disposal area, and the dikes cannot be raised again until the powerlines are relocated or raised. There is not sufficient clearance between the top of the dike and the low (sag) point of the powerlines. Disposal area 2A will not be used for this harbor expansion project.

5.1.10. Disposal Areas 12A, 12B, 13A, 13B, 14A, and 14B.

Disposal areas 12A, 12B, 13A, 13B are all diked disposal areas and are contiguous. They are located from south of the Highway 17 bridge east to Area 13B. These areas will be used in the expansion project, except for Disposal area 13B. It will not be used for harbor expansion because of a scheduled disposal area improvement project. Disposal area 14A is not diked and cannot be used again until dikes and an interior bird island are constructed and other mitigation is completed. Disposal area 14B is contiguous to 14A, is diked, and will be used in the expansion project. Dredged material from the sediment basin is generally placed into 12A, 12B, and 13A

5.1.11. Jones/Oysterbed Island Disposal Area.

This area is the lowermost upland confined disposal area for the harbor. A portion of this disposal area is within the limits of the Tybee National Wildlife Refuge. This area will be used for the expansion project.

5.1.12. Ocean Dredged Material Disposal Site.

Material from Station 0+000 to the seaward end of the entrance channel is generally removed by hopper dredges and placed into the offshore disposal area. The site has water depths ranging from –22 feet, MLW to –47 feet, MLW.

5.2. Operation And Maintenance Practices

5.2.1. Advanced Maintenance

Advanced maintenance has been authorized in Savannah Harbor. It is the additional depth specified to be dredged beyond the authorized project dimensions for the purpose of reducing overall maintenance costs by decreasing the frequency of dredging. The existing project dimensions and authorized advance maintenance depths are listed in Figure 5-4.

Figure 5-4 Existing Project Dimensions and Advance Maintenance Provisions

STATION	PROJECT DEPTH (-ft MLW)	BOTTOM WIDTH (ft)	ADVANCE MAINTENANCE (ft)	MAINTENANCE DREDGING DEPTH (-ft MLW)
Inner Harbor				
103+000 to 102+000	42	400	0	42
102+000 to 100+000	42	400	2	44
100+000 to 79+000	42	500	2	44
79+000 to 70+000	42	500	2	44
70+000 to 50+000	42	500	4	46
50+000 to 41+000	42	500	4	46
41+000 to 24+000	42	500	4	46
24+000 to 0+000	42	500	2	44
Entrance Channel				
0+000 to –14+000B	42	500	2	44
-14+000B to -60+000B	44	600	0	44

Source: Engineering Appendix.

5.2.2. Operational Procedures

The existing navigation channel is not presently designed to provide two-way traffic for all vessels using the project. However, the harbor pilots indicated that they have instituted their own system of traffic control that allows them to have two-way traffic in certain reaches. The traffic control system generally consists of the pilots onboard any vessel under way being in constant contact with pilots on other moving vessels. This permits the pilots to adjust the speed of the vessel and time meetings when the vessels are in reaches where the currents, channel banks, and/or other moored vessels do not affect the handling of the vessels under way.

According to the pilots, deep draft vessels avoid meeting in the City Front Channel (approximately Stations 80+000 to 70+000) and in the Bight Channel (approximately Stations 55+000 to 40+000). These are areas where ships are aligning to transit under the Talmadge Bridge or tidal currents affect ship handling. The harbor pilots also indicated that they require four feet of underkeel clearance to move a vessel. Vessels

drafting more than 38 feet wait for adequate tide stage to provide the desired underkeel clearance.

The harbor pilots indicated there are reaches in the channel where they are presently having difficulty maneuvering deep draft vessels. One area is the bend in the vicinity of Station 36+000. They indicated that the currents on the outside of this bend effect vessels on an inbound transit and additional width would help them navigate through this reach. In addition, the reach between Stations 72+000 and 59+000 is difficult to navigate on the north side during certain stages of the tide. Additional width through this turn would be beneficial.

5.2.3. Shoaling and Maintenance

A detailed discussion of shoaling rates and locations is included in the Engineering Appendix. Maintenance dredging in the entrance channel and inner harbor is performed regularly in Savannah Harbor. Maintenance dredging in the entrance channel is performed by hopper dredges that generally work from December through March of each year. Dredging is restricted to this period to minimize the impact dredging has on endangered sea turtles. Pipeline dredges perform maintenance dredging in the inner harbor. At the present time, dredging upstream of Mile 5 (approximately Station 26+000) cannot be performed between 15 March and 30 May of each year. This restriction is imposed by the Georgia Department of Natural Resources to protect the spawning of striped bass in the upper estuary of the harbor. Maintenance dredging is generally being performed in the harbor throughout the year except during the restricted times.

The long-term historical average annual shoaling rate in Savannah Harbor of 7.2 million cubic yards per year has remained relatively constant over the last 45 years. The estuary appears to be in equilibrium, and the inflow from upstream is controlled by a series of major reservoirs. The sediment basin continues to function even though the tide gate structure was taken out of operation in 1990. The Kings Island turning basin functions as a sediment trap in the upper reaches of the harbor and 6 feet of additional advance maintenance will be completed prior to the commencement of the expansion dredging.

5.3. Environmental Considerations

5.3.1. National Wildlife Refuges

There are two national wildlife refuges adjacent to Savannah Harbor.

The Savannah National Wildlife Refuge contains approximately 26,500 acres of freshwater marshes, bottomland hardwood swamp, tidal rivers, and creeks. It is located along the northern side of the harbor just upstream of Hutchinson Island to the upper end of the project, and the total refuge extends up to navigation cut and bend #4 near River Mile 40. This area is managed for various fish and wildlife resources, concentrating on migratory waterfowl.

The Tybee National Wildlife Refuge was established in 1938 as a site for the protection of unique coastal wildlife species. It is located along the northern side of the lower harbor. The refuge includes a portion of the Jones/Oysterbed Island Disposal Area.

5.3.2. Groundwater

In the past, any proposed deepening of Savannah Harbor has raised questions about the possible effects this action would have on the confining layer of the principal artesian aquifer, known as the Floridan aquifer. Breaching of the confining layer could have serious consequences as the aquifer is the primary supply of fresh water for the city of Savannah, neighboring areas in South Carolina including Hilton Head Island, and virtually the entire coastal area of Georgia.

Additional information was needed during this feasibility study to adequately assess the possible effects of a deepened channel on the Upper Floridan (principal artesian) aquifer that underlies the entire project area. Additional studies were conducted to verify the generalized data available from previous studies of the aquifer. These studies also evaluated potential impacts to the confining layer due to removing some confining and relict stream channel material during a deepening project.

5.3.3. Hazardous, Toxic, and Radioactive Wastes

The Savannah Harbor is home to numerous industries and shipping activities. Each of these presents a potential for contamination to the harbor either due to regular practices or accidents. In addition, there is always the potential for illegal discharges of hazardous, toxic, or radioactive wastes (HTRW), either by an individual or by industry. These types of activities are usually reported or discovered and any threats to the environment are minimized. In any instance, discharges of HTRW to the harbor waters usually pose no threat of accumulation in the bottom sediments. This is due to the great amount of dilution and dispersion caused by the regular flow of waters in the harbor.

5.4. Cultural Resources

There are two historic sites in Savannah Harbor that could be affected by any harbor expansion project. Old Fort Jackson is located at the approximate center of the inner harbor and the CSS Georgia wreck is located across the channel from the fort.

5.4.1. Old Fort Jackson

Old Fort Jackson Historic Site is owned by the State of Georgia and administered by the Coastal Heritage Society. The site consists of a brick fort, moat, and surrounding buried archaeological deposits. It is significant for its architecture, association with important events, and archaeology. It is located about 3 miles east of the city of Savannah at Station 58+500. The bank on either side of the fort has a history of erosion problems. Since the 1970s, the Corps of Engineers has pumped dredged material around the fort to raise the ground elevation to reduce flooding. It also placed riprap

on the riverbank adjacent to the fort property and constructed a steel sheet pile wall at the intake structure for the moat. The moat wall sits on the riverbank and has been hit by a ship on one occasion.

The Corps of Engineers, Savannah District, has prepared a Memorandum of Agreement between the District, the State of Georgia, the Coastal Heritage Society, and the Advisory Council on Historic Preservation which specifies procedures for determining the causes of the erosion problem, any possible Federal involvement with the problem, potential solutions, and funding sources. The Agreement is included in the Environmental Impact Statement. Most of the engineering studies required by the Agreement will be conducted as part of the proposed Savannah Harbor Expansion Project during the Continuing Engineering and Design (CED) phase.

5.4.2. CSS Georgia

The CSS Georgia is the wreck of a Confederate ironclad constructed in Savannah in 1862 and scuttled to prevent capture in 1864. It is located on the north side slope of the navigation channel across the river from Old Fort Jackson. The wreck site is significant at the National level for its architecture, associations with events and people, and for its archaeology. The site was first located in 1968 when it was impacted by a harbor-widening project.

Maintenance dredging operations were modified to lessen impacts to the vessel. A side slope stability analysis indicated the side slope on the north side of the channel would remain stable if dredging were not performed. Present maintenance dredging procedures restrict dredging a 1,000-foot long reach of the channel between Stations 58+000 and 59+000 100 feet off the north toe. This is to ensure that the wreck is not damaged, nor the side slopes impacted, by dredging and also to prevent disturbance of possible live ordnance that has been reported to exist adjacent to the wreck. Maintenance dredging in the remaining 400-foot wide by 1,000-foot long section of this reach is performed when required. This reach has 4 feet of advance maintenance and is dredged to -42' MLW. A 400-foot wide channel with approach transitions, for width and depth, 1,000 feet long is the current design channel through this reach.

Savannah District has prepared a Memorandum of Agreement between the District and the states of Georgia and South Carolina and the Advisory Council on Historic Preservation which identifies impacts to the site, the Federal interest in mitigating these impacts, mitigation alternatives, and funding sources. The Agreement is included in the Environmental Impact Statement.

5.5. Socioeconomic Considerations

5.5.1. Human Resources

Human resources of the study area include the populations of Chatham County in Georgia and Jasper County in South Carolina. The two counties had a 1990 population of 237,000.

5.5.2. Development and Economy

There is a significant economic impact from the Port of Savannah on its surrounding area and the state of Georgia. Economic impacts can be measured in terms of direct and indirect employment, income, and industry revenues. The impacts are greatest in Chatham and Jasper counties yet affect the entire surrounding region. In 1997, Booz·Allen & Hamilton conducted an *Economic Impact Study* for the Georgia Ports Authority's Savannah facilities. This study found that the number of employees in organizations that are connected with port commerce from the Port of Savannah exceeds 67,000. The economic impact to the region is greatest for containerized cargo as this high value cargo represents a very large share of the value of commodities handled at the Port of Savannah. Figure 5.5 summarizes the impact of cargo activity from the Port of Savannah, breaking out the impacts of container cargoes from other cargoes and the total.

Figure 5-5 Direct, Induced, and Related Economic Impact from Savannah Harbor by Cargo Type

ECONOMIC IMPACT CATEGORY	CONTAINERS		OTHER CARGO		TOTAL	
	NO.	PERCENT OF TOTAL	NO.	PERCENT OF TOTAL	NO.	PERCENT OF TOTAL
Jobs	58,220	86%	9,416	14%	67,636	100%
Wages	$1,272	84%	$236	16%	$1,508	100%
Sales & Revenue	$16,437	84%	$3,025	16%	$19,462	100%
State & Local Taxes	$420	85%	$76	15%	496	100%

Source: Booz·Allen & Hamilton *Economic Impact Study*, 1997.

The Port of Savannah's container activity produces about 84 percent of the Ports' total economic impact to the State and broader region. Economic impact may be defined by jobs, wages, sales & revenue, and state and local taxes. Total economic impacts include direct, induced (indirect and secondary), and related categories. Remaining benefits are generated from breakbulk and bulk commodities moving through the Port and account for 16 percent of total economic benefits.

Containers generate roughly five times the economic impacts provided by a ton of break-bulk cargo, such as paper products, and ten times the impacts provided by a ton of bulk products, such as grain. These underscore the important role played by the Port of Savannah and particularly its Garden City Container Terminal in the economy of the region.

5.6. Military Rapid Deployment

The Port of Savannah is one of seven strategic seaports designated to support deployment of selected armed forces combat units and support elements. The Port of Savannah is the designated Sea Port of Embarkation for vehicles and equipment from the 3rd Infantry Division (Mechanized) at Fort Stewart, helicopters from Hunter Army Airfield, and elements from the 24th Infantry Division, Fort Benning. The military vessels that are used for deployment at the Port include large roll-on/roll-off fast sealift ships 946-feet long with a loaded draft of 37-38 feet. Since emergency deployment can occur at any time, it is vital to national security that the navigation channel and designated container berths at Garden City Terminal be maintained at an adequate depth to accommodate these vessels. There is no alternate port of embarkation for deployment by these installations. The current 42-foot project provides adequate channel depth for rapid deployment from the Port of Savannah.

6. PROBLEM IDENTIFICATION

6.1. Future Conditions Without Project

In order to evaluate impacts of alternatives for harbor expansion, it was necessary to predict conditions that will likely occur in the future without an expansion project. This baseline condition considers an analysis period of 50 years.

6.1.1. Federal Navigation Project

There are no plans by Federal, state, or other agencies to deepen, expand, or otherwise improve the navigation project in the absence of a harbor expansion project addressed by this study.

6.1.2. Operation and Maintenance

Annual operation and maintenance practices will continue under current procedures. There is no indication that shoaling rates and dredging volumes will change appreciably in the future.

6.1.3. Environmental Resources

Without a harbor expansion project, environmental impacts similar to those presently experienced would be expected to continue. Temporary destruction of the habitat for estuarine animals that are found in the sediments, primarily worms and other invertebrates, would continue with maintenance dredging. This impact would be relieved as nearby pioneer species invade the new habitat and reestablish populations.

Sediments that are routinely removed from the channel by maintenance dredging would continue to be placed in the confined disposal areas. Impacts that have occurred as a result of prior continuing disposal operations would continue. Habitat that has been altered in the disposal areas during past dredging would be covered and lost to the species of the area. New individuals would be expected to recolonize the newly exposed habitat. Impacts from the confined disposal area weir effluent would be expected to continue during the periodic dredging cycle. Species of fish and other estuarine life that use sites adjacent to the weirs when no discharges are occurring may leave the area when the weirs are used and return when discharges cease.

Most of the environmental conditions of the area are not expected to change significantly during the 50-year period of analysis. Aquatic habitats should therefore remain relatively stable. Some of the marsh vegetation along Middle and Back Rivers may change to some degree in response to the lower salinity which resulted from taking the tide gate structure out of operation. Earlier studies indicated succession was in progress following removal of the Tide Gate from service. Studies conducted as part of this expansion project indicated the rate and extent of this succession may be occurring to a lesser degree than previously believed. The areal extent of marshes may decrease slightly throughout the harbor as development continues along the edges of the marshes.

6.1.4. Port Installations and Facilities

The Port of Savannah is currently investing in port infrastructure, including berths, cranes, and container storage/staging areas, to support current and near future expansion of cargo volumes. Additionally, future expansion of port and landside transportation infrastructure is planned. Future investments in harbor deepening and port infrastructure are interlinked. Without deepening current and future carriers serving the port will incur operating constraints and subsequent impacts to their competitive cost position. Inadequate water depth will also impact carrier decisions regarding the size of vessels serving Savannah and fleet deployment. The fleet serving the port, in combination with the volume of cargoes moving through the port, will impact the size and capabilities required of Savannah's future port facilities.

6.1.5. Socioeconomic Considerations

The population of the study area is projected by the Bureau of Economic Analysis, Department of Commerce, to increase from 237,000 in 1990 to 292,000 in the year 2035. This represents an overall population increase of about 23 percent between the years 1990 and 2035. This compares with the expected population growth of 35 percent for the state of Georgia, 45 percent for the state of South Carolina, and 28 percent for the United States, as a whole, over the same period.

Under With and Without Project conditions, it is estimated that container volumes through the port will remain constant. However, shippers' cost of transporting containerized cargo through the port will decrease from current levels under various with project conditions. Lower transportation cost will result from ocean carriers incurring fewer operating constraints, such as tidal delays and light loading, and fleet forecasts indicating that carriers will use larger capacity, deep draft vessels, which are more economical, to serve the port. The ability of ocean carriers to achieve greater operating efficiencies is directly correlated with shippers ability to lower transportation costs.

Under without project conditions, these probable transportation cost savings such as economic impacts will not be achieved. Similarly, corresponding this could impact the competitive and market position of the Port, in addition to businesses that rely on it for transportation of import and export products.

6.2. Problems And Opportunities

The existing conditions at Savannah Harbor result in problems for existing and projected future commercial navigation. However, a sound plan to address these problems can result in an opportunity for the Port of Savannah to remain a world class port capable of servicing all likely projected demands.

6.2.1. Problems

The currently authorized channel depths in Savannah Harbor continue to constrain traffic. Under present conditions, many ships calling the port incur costly tidal delays and light loading. As traffic continues to increase, and as vessels in the world fleet continue to grow in size due to the retirement of smaller ships, in the absence of a harbor expansion plan the problem will only become worse in the future. Some shippers modify vessel itineraries in order to accommodate the existing channel depths in Savannah. These companies have indicated it would be more economical to use a deeper port of call, which a deeper channel in Savannah Harbor would allow them to do.

The foremost problems in Savannah Harbor are:

- Existing shippers are experiencing increased costs due to light loading and tidal delays.
- Light loading and tidal delays will increase as present harbor users increase their annual tonnage and as larger, more efficient ships replace older, smaller ones.
- Existing ships are experiencing problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor.

Channel Depths. The Port of Savannah provides a world-class harbor and port facilities. However, the size of vessels calling on the Port has constantly increased over the past years. Due to the large tidal fluctuation within the harbor, from 8 to 10 feet, some vessels must presently wait for favorable tides before transiting the inner harbor.

Demand for maritime containerized and non-container cargo passing through the Port of Savannah and the size of vessels calling on the Port continue to grow. The rate of containerized cargo growth at the Port is higher than the United States as a whole because Savannah has a greater share of trade with developing regions of the world.

In order to accommodate future world fleet traffic, particularly Post-Panamax containership vessels with design drafts from 41 to over 44 feet, the harbor must provide substantially greater channel depths. The present authorized channel in the inner harbor is only 42 feet deep. Without improved channel depths, future vessels serving the Port of Savannah will incur operating restrictions that may result in suboptimal transportation costs to carriers and shippers.

Channel Widths. Harbor pilots have indicated there are portions of the inner harbor where it is difficult to maneuver deep draft vessels. Additional widths through these reaches would be beneficial for safe and expedient transit.

Channel Alignment. The present channel alignment and channel geometry results in maneuvering difficulties at several reaches throughout the inner harbor. These problems will be compounded as larger vessels call on the Port of Savannah.

Turning Basins. The depth, width, and length of Kings Island Turning Basin are presently barely adequate for the existing ships calling on Savannah. Any harbor expansion project should also include deepening the turning basin to the same depth as the adjacent channel. The length and width should be increased to allow safer maneuvering of existing and projected larger vessels.

6.2.2. Opportunities

The Port of Savannah has the opportunity to continue to play a major role in the United States containerized export market, if harbor facilities are upgraded to meet future needs. The Georgia Ports Authority has an aggressive expansion program for port facilities and infrastructure. The Port of Savannah is fortunate to have no major physical barriers that would preclude implementation of the harbor expansion projects evaluated. Continued expansion of port related activity would stimulate growth in employment and investment in the Savannah area. The economy is relatively mature, however, and employment growth rates will most likely be highest in the service sector. Manufacturing is the largest employment sector, but growth rates in manufacturing and port related businesses would not be as high as that of services, but the growth in total employment could be significant in these industries if the Port continues to flourish.

6.3. Constraints

In planning for optimum harbor operation and maintenance, there are issues and factors that may limit or constrain implementation of desirable activities. The following is a summary of these major constraints, some of which may be subject to improvement.

6.3.1. Life of Disposal Areas

The useful life of active dredged material disposal areas is critical. With no foreseeable reduction in the volume of maintenance dredging, availability of disposal areas in close proximity to dredging activities is an important factor in reducing the annual cost of harbor maintenance. Available land for new disposal areas near dredging activities is increasingly scarce or nonexistent. The Dredged Material Management Plan in the Engineering Appendix shows there is adequate disposal area capacity to accommodate a harbor expansion project plus the 50-year future maintenance dredging under the management practices contained in the LTMS.

6.3.2. Multiple Regulatory Jurisdictions

The states of Georgia and South Carolina both have regulatory authority over existing conditions and proposed improvements in Savannah Harbor. It is necessary to obtain appropriate environmental and other permits and clearances from both states before performing any harbor improvement. In addition to the duplication of efforts required to obtain environmental, cultural resources, and other clearances, policies and procedures often vary between the two states.

6.3.3. Environmental Impacts

Construction of the first harbor-deepening project resulted in alterations to the natural ecosystem in the harbor and tidal estuary. Harbor deepening allows salinity levels to move further upstream in response to tidal influences. This has potential effects on the salinity and dissolved oxygen in the estuary, particularly the Savannah National Wildlife Refuge. A portion of the Wildlife Refuge is within the project boundaries.

The actual levels of salinity and dissolved oxygen, under current conditions and with any proposed harbor expansion project, are difficult to predict because of the complex and varying river flows and tidal influences. The U.S. Fish and Wildlife Service is dedicated to protecting and enhancing the refuge, while the states of Georgia and South Carolina are concerned about the habitat and spawning of striped bass and shortnose sturgeon. Any navigation project modification must include careful consideration of potential adverse environmental impacts that might result.

7. FORMULATION AND EVALUATION OF INITIAL ALTERNATIVES

A major study objective was to complete the final Feasibility Report in time to be eligible for authorization in the Water Resources Development Act of 1998. This required some extraordinary approaches for the plan formulation process. A major scoping guideline was that a 50-foot deepening project would be the maximum practicable alternative. The initial engineering, economic, and environmental analyses included detailed evaluations of this "worst case" option. Initial harbor expansion alternatives were developed by scaling, not necessarily linearly, the design and effects of alternatives less than 50 feet. Many design features and environmental impacts of the harbor expansion alternatives were identical, which simplified the formulation and evaluation of all initial alternatives.

As the study progressed, the engineering analysis in particular focused more on the design and cost of the individual alternatives with less emphasis on scaling from the 50-foot features. In comparison, the economic analysis evaluated and quantified navigational benefits for each deepening alternative (44', 46', 48', and 50'). The cultural resources investigations concluded that the cultural resources impacts and mitigation were identical for any harbor expansion project.

The environmental analysis continued to utilize the worst case option with being more linked to the 50-foot option. This approach is consistent with the decision regarding feasibility and specifically provided for within NEPA. The major environmental issues were identical for all harbor expansion alternatives, although the level of impacts, primarily salinity and dissolved oxygen, are likely to vary with increasing deepening depths. Consistent with NEPA, the specific details will be determined during CED and presented in a Tier II EIS subject to public review and input.

With each iteration, the costs, benefits, and impacts of the alternatives and recommended plan became increasingly refined and detailed. The most explicit description of each item is included in the discussion of the Recommended Plan.

The Plan Formulation process consisted of several distinct phases:

1) Define Without Project conditions.

2) Formulate initial harbor expansion alternatives.

3) Develop preliminary benefits and costs for initial alternatives.

4) Select final alternatives for more detailed investigation.

5) Refine preliminary benefits and costs for final alternatives

At this point, refined preliminary costs would normally be used to select the National Economic Development (NED) Plan and a detailed MCACES and CEDEP cost estimate would be prepared only for the NED Plan. However, late in the study the economic benefits of all of the harbor expansion alternatives were revised. There was not

sufficient time to wait for completion of revised benefits, select the NED Plan, and then prepare an MCACES and CEDEP cost estimate for the NED Plan and possibly a separate Locally Preferred Plan. Therefore, the Study Team elected to develop MCACES and CEDEP cost estimates for those alternatives most likely to include the NED Plan and the Locally Preferred Plan. These MCACES and CEDEP cost estimates were therefore used in the selection of the NED Plan. Therefore, the remaining major study phases were:

6) Prepare MCACES and CEDEP cost estimates for the final alternatives.

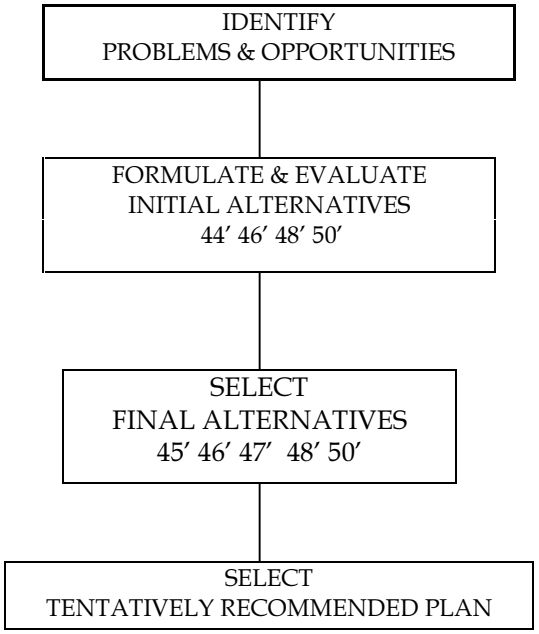
7) Select the NED Plan.

8) Select the Locally Preferred Plan, if different from the NED Plan.

9) Describe implementation of the Recommended Plan.

Figure 7-1 illustrates the iterative plan formulation and evaluation process followed during this feasibility study.

Figure 7-1 Plan Formulation Process



7.1. Components Of Harbor Expansion Alternatives

There are a limited number of actions which can be taken in response to the problems and needs in Savannah Harbor:

- Make no improvements to the harbor and channel (No Action/Without Project Condition).

- Deepen the inner harbor channel and entrance channel.
- Increase capacity of existing dredged material disposal sites.
- Create new dredged material disposal sites.
- Provide wideners at locations with maneuvering difficulties.
- Realign channels to increase vessel operating safety and speed.
- Enlarge turning basins to improve vessel safety and maneuvering.

The first option, No Action/Without Project Condition, would not meet existing and projected needs. However, all harbor expansion alternatives are measured against the Without Project Condition.

7.1.1. Design Vessel

The design vessel was determined by examining the size of ships that could reasonably be expected to call on the Port of Savannah in the future if a harbor expansion project were to be implemented. The design vessel used in the engineering and design considerations for this expansion project is the Regina Maersk, a post-Panamax II-class container vessel. This class vessel was first launched in 1996. The ship is 1,044 feet long with a beam of 140.4 feet and a design draft of 45.9 feet. The Regina Maersk was designed to carry approximately 6,000 TEU's.

7.1.2. Ship Simulation Studies

A ship simulation model is normally used during the feasibility phase to evaluate channel alignment problems and possible improvements. However, due to the schedule for submission of the final Feasibility Report, it was decided to conduct a ship simulator study during the CED phase. For the feasibility study, the channel alignment was evaluated using design manuals, experience and input from harbor and docking pilots.

7.1.3. Underkeel Clearance

Underkeel clearance at low tide was computed for vessels transiting the project. Clearance includes squat, trim, and sinkage when transiting from salt water to brackish water. Additional details of computation of underkeel clearance are included in the Engineering Appendix.

7.1.3.1 Squat.

Ship squat in a restricted channel depends primarily on ship speed. Therefore, the pilots have some control over a vessel's speed and the resulting amount of squat and underkeel clearance. The cross-sectional areas of channel and ship geometry also affect the amount of squat a vessel will experience.

7.1.3.2 Effects of Fresh Water

Drafts of ships calling at the Port of Savannah will increase by approximately 2.6 percent when transiting from salt water to fresh water. For the design vessel, the draft will increase approximately 1.2 feet when transiting from salt water to fresh water.

7.1.3.3 Safety Clearance.

For safety purposes, a clearance of 2 feet between the bottom of a vessel and the design channel bottom is included to avoid damage to the ship's hull, propellers, and rudder from bottom irregularities and debris. An additional 2 feet of underkeel clearance was included in the entrance channel from Stations –14+000B to the ocean end of the entrance channel to allow for heave, pitch, and roll of the vessel in wave conditions.

7.1.3.4 Total Clearance.

It is anticipated that the present practice by the harbor pilots to provide at least 4 feet of clearance under the keel will continue after completion of any harbor expansion project. In the event this clearance is not available; pilots will wait to take advantage of the tide.

7.1.4. Channel Depths

The present channel depth of 42 feet in the inner harbor is not adequate for existing and projected larger vessels. In order to meet existing and projected conditions, the inner harbor should be deepened from its present depth of 42 feet up to a maximum of 50 feet. For each alternative, the entrance channel from Station –14+000B to the ocean end of the entrance channel would be 2 feet deeper than the inner harbor.

7.1.5. Channel Widths

During discussions with the harbor pilots and U.S. Coast Guard, they each emphasized that the bottom width should be kept as wide as possible. This would allow them the most flexibility in the movement of vessels and would permit them to continue to use the internal traffic control procedures they practice for the existing project. Much of the harbor is developed on both sides and there is little room for increasing the width of the navigation channel without having a significant impact on adjacent structures and property. A major study objective was to minimize impacts to real estate and structures along the bank. To accomplish this objective, the project was designed to maintain the authorized bottom width at the 42-foot project depth and project the side slopes at a 1 vertical (V) on 3 horizontal (H) slope to the channel depth associated with each expansion alternative.

Wideners have been included in areas where the pilots indicated they presently have difficulty maneuvering as a result of either tidal currents or bank effects in the channel. The widener analysis, which is included in the Engineering Appendix, concluded that a new widener should also be included upstream of the Kings Island Turning Basin. This widener would require relocation of an existing dike and loss of a significant

portion of disposal area 2A. The amount of enlargement of the turning basin is constrained by the proximity of the adjacent disposal area dike.

The existing project and each of the harbor expansion alternatives were not designed to provide for two-way traffic for the presence of two design vessels. However, smaller vessels do presently meet and have two-way traffic at the discretion of the pilots. This practice is expected to continue as long as the pilots can ensure safe navigation in the project.

7.1.6. Channel Alignment

The bank-to-bank width of the Savannah River varies between the mouth of the river to the upper end of the project. The reach of the harbor upstream of Old Fort Jackson is generally not as wide as the reach downstream of the fort. The upstream reach of the river has commercial and port development located continuously along the south bank. The north bank has commercially developed areas as well as being the location for numerous confined disposal areas provided by the local sponsor for disposal areas which is used to maintain the Federal project. There is also a confined disposal area constructed by a private interest, which is used for dredging private berths. There are no commercially developed areas on the north bank in the lower harbor. This lower harbor area contains most of the disposal areas that are used to maintain the existing Federal project. The south bank has some commercial development.

One of the study design goals was to minimize the amount of real estate that would be required to construct and maintain a harbor expansion project. The commercial land values in the harbor are high and in many areas, there is insufficient room to relocate existing facilities and still have them remain operational. There are two constituents considered in the channel design -- channel alignment and channel geometry. The alignment is the horizontal position of the centerline of the channel. The geometry is the cross-section of the channel and includes the location of the channel toes with respect to the centerline, the channel width and depth, and the configuration of the side slopes. Ideally, the channel should have as few curves as possible. However, the Savannah River navigation channel meanders with the river and the commercial development and confined disposal areas located throughout the harbor makes it uneconomical to make significant modifications to the existing alignment.

7.1.7. Utility and Bridge Crossings

There are four submerged pipelines, one overhead electric transmission line, and one bridge across the navigation channel. A slight shift in the channel alignment between Stations 52+800 and 49+750 will be required to avoid the submerged pipelines. U.S. Highway 17 bridge over the Savannah River at Station 79+150 has a vertical clearance at mean high water of 185 feet and is not an obstruction to the design vessel.

7.1.8. Turning Basin Improvements

The only turning basin improvement with any harbor expansion project would be enlarging the width of Kings Island Turning Basin to 1,676 feet and dredging the basin to the same depth as the project depth of the adjacent channel.

7.1.9. Disposal Areas

The confined disposal areas would continue to be used for disposal of dredged material from the inner harbor. If the volume of dredged material, both new work under an expansion project and maintenance dredging, exceed the capacities of the disposal sites, dike raising within the appropriate disposal areas would be provided to increase capacities. The ocean disposal site would be used for disposal of all dredged material from the entrance channel if beneficial uses to be further examined in the CED phase prove to not be more cost effective.

7.1.10. Components Selected for Harbor Expansion Alternatives

In order to meet study objectives, all harbor expansion alternatives must provide a deeper channel, wideners, and improvements to Kings Island Turning Basin.

7.2. Formulation Of Initial Alternatives

The currently authorized project provides for a 42-foot depth in the inner harbor and 42/44 feet in the entrance channel. Four harbor expansion alternatives were selected for initial evaluation. These included depths of 44, 46, 48, and 50 feet in the inner harbor (Stations 0+000 to 103+000) and in the entrance channel (Stations 0+000 to –14+000B) with an additional 2 feet in the entrance channel from Station –14+000b to the ocean end of the entrance channel.

7.2.1. No Action Alternative

The No Action, or Without Project Condition, would consist of a continuation of the existing authorized channel dimensions with no harbor improvements. Periodic maintenance dredging would continue.

7.2.2. Alternative 44 (44' Deepening)

Alternative 44 would include dredging the inner harbor to 44 feet and dredging the entrance channel to 44/46 feet, enlarging Kings Island Turning Basin and dredging to 44 feet, and providing ten wideners in the inner harbor and two wideners in the entrance channel.

7.2.3. Alternative 46 (46' Deepening)

Alternative 46 would include dredging the inner harbor to 46 feet and dredging the entrance channel to 46/48 feet, enlarging Kings Island Turning Basin and dredging to 46 feet, and providing ten wideners in the inner harbor and two wideners in the entrance channel.

7.2.4. Alternative 48 (48' Deepening)

Alternative 48 would include dredging the inner harbor to 48 feet and dredging the entrance channel to 48/50 feet, enlarging Kings Island Turning Basin and dredging to 48 feet, and providing ten wideners in the inner harbor and two wideners in the entrance channel.

7.2.5. Alternative 50 (50' Deepening)

Alternative 50 would include dredging the inner harbor to 50 feet and dredging the entrance channel to 50/52 feet, enlarging Kings Island Turning Basin and dredging to 50 feet, and providing ten wideners in the inner harbor and two wideners in the entrance channel.

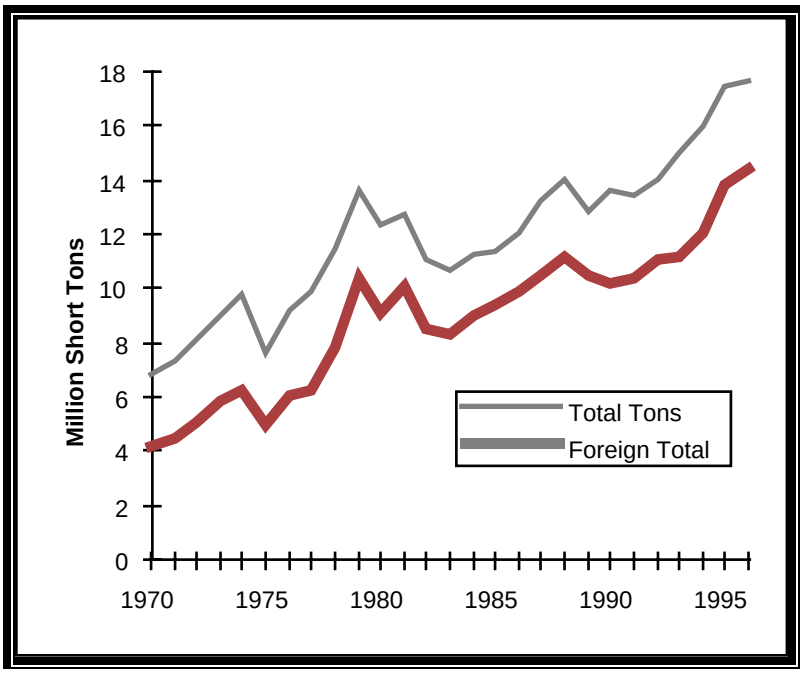
7.3. Economic Analysis Of Initial Alternatives

The detailed economic analysis, including all assumptions, a description of methodology, and detailed findings, is included in Appendix C. The economic analysis consisted of five major areas:

1. Commodity Forecast
2. Fleet Forecast
3. Net Benefit/Cost Analysis
4. Multiport Analysis
5. Risk and Uncertainty Analysis

Existing conditions for trade flows moving through the Port of Savannah are increasingly characterized by cargoes supporting foreign trade. Containerized cargo volumes have increased for each of the last nine years. Total tons through the port have increased correspondingly up to a total of 17.6 million short tons of waterborne commerce in 1996 of which 82 percent (14.4 million short tons) was foreign cargo. As shown in Figure 7-2, the foreign tonnage share of Savannah Harbor waterborne commerce has increased for over twenty-five years. Foreign tonnage growth has averaged 9.5 percent per year over this period.

Figure 7-2 Total and Foreign Tonnage 1970 - 1996 (Million Short Tons)



Source: USACE Waterborne Commerce Statistics

Domestic shipments have increased slowly over this period, with growth in coastwise shipments averaging 1.7 percent per year. Petroleum and petroleum products comprise 70 percent of domestic tonnage. The Georgia Ports Authority reports handling 650,253 TEUs though Savannah Harbor in 1996 which accounts for 5 million of the 18 million cargo tons through the port. Savannah's container TEU volumes have increased over 200 percent during the last 13 years.

The need for additional Savannah Harbor channel depth is driven primarily from increasing vessel operating draft requirements of container vessels calling the Port. In earlier deepening studies for Savannah Harbor, non-containerized cargoes, such as grain and kaolin clay, benefited from deepening to 40 feet or 42 feet. In this study, non-containerized commodity use of deeper channel alternatives is limited to a small portion of the fleet. One of the contributing factors has been the shift of Savannah's grain export volumes to GPA facilities at Brunswick to make room for additional GPA container berth expansion in Savannah Harbor. Therefore, the primary focus of the commodity trade analysis addresses containerized cargo.

The major problems presently faced by carriers and shippers serving the Port of Savannah include:

- The current fleet operates at less than optimum capacity, incurring higher transportation costs.
- Vessels incur tidal delay costs waiting for sufficient water depth to meet required under keel clearance.

The obvious solution to these existing problems is to deepen Savannah's shipping channel. Channel deepening would provide carriers with the opportunity to fully utilize available vessel cargo capacity and deploy larger vessels to achieve economies of scale and reduce tidal delays that ultimately should result in transportation costs to shippers.

7.3.1. Trade Forecast

For thoroughness of trade analysis for this study, commodity trade forecasts have been acquired from ICF Kaiser's Trade and Transportation Group. ICF Kaiser is one of the primary commercial providers of detailed ocean borne trade forecasts. The ICF Kaiser trade modeling system forecasts trade through a structure of global commodity models that capture individual country demand for imports, linked to economic growth and domestic production within each country[1]. The macroeconomic forecasts used in this system are sourced from the country and regional economic models produced by the WEFA Group, an economic forecasting firm associated with the University of Pennsylvania. The trade model output includes individual commodity movements, both in terms of U.S. dollars and metric tons. For liner trades, the model also produces trade volumes in TEUs. For the United States, trade is further disaggregated by port range, including the South Atlantic.

As the study period extends a full fifty years, ICF Kaiser prepared a long-term global trade forecast that expands their standard twenty-five year forecast horizon out to 2050. A very long-term global macroeconomic growth model combining production and consumption trends with the existing long-term demographic and productivity forecasts was used to produce the trade for the latter decades of the period[2].

The commodity trade modeling system builds upon a base of detailed historical commodity trade data and individual macroeconomic country model forecasts to develop a global model for each commodity group. These global commodity models have a pooled cross sectional least squares regression structure that captures as much predictive capability as possible from historical commodity trade data. An expert

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[1] *The ICF Kaiser trade models were developed under the direction of Dr. David Blond. Earlier versions of his trade modeling system have been used in deep draft navigation Feasibility Studies for the US Army Corps of Engineers for over ten years.*

[2] *An extensive explanation of the global trade model forecasting methodology, as used in this study, is found in Chapters 9 and of this Appendix. As documented in those chapters, the trade forecasting methodology uses an advanced trade model structure, extensive historical data from multiple sources, and a rule-based expert system to produce complete global forecasts of 82 individual commodity categories in value and volume.*

system tests the estimated models for robustness and substitutes a propensity to import model forecast where necessary. For the portion of liner trade that is containerized, tonnage forecasts are transformed into TEU volume measures using commodity, route, and direction-specific conversion factors. The TEU forecasts represent movements of containers loaded with cargo between countries – not the repositioning of empty containers or the transfers, via domestic barge or feeder vessel, between domestic ports of international containers. However, the carriage of empties is reflected in both the utilization of vessels and the light loading patterns used in the fleet forecast and transportation costs analysis. Among the assumptions for the trade forecast were the following:

- The study period is 2000 to 2050, with base year of 1996.
- Landside infrastructure and land transportation capacity will be expanded to accommodate increased volumes of trade over the entire forecast period.
- There will be no significant changes to cabotage rules. The Jones Act and the anti-trust immunity for industry rate setting conferences continues for the purposes of our analysis. Similarly, labor work rules for port operations are assumed to remain relatively constant throughout the forecast period, though technology improvements will continue to enhance long run worker productivity.
- The definition of commodity flow is based on counting each import or export movement one time for trade forecasting purposes. Over the long-term, it is assumed that demand for transportation is observed only for efficient movement of cargoes (and the positioning of transportation equipment to service this demand.) It is possible that carriers may choose to handle cargo in a way that incurs double handling charges by moving through multiple ports. However, this operational pattern will not change the underlying factors influencing demand for country-to-country international trade movement, and the forecast does not capture such double handling movements.
- The fundamental economic development perspective of the WEFA Group and ICF Kaiser economic forecasts utilized is based on a belief in continued economic growth. It is assumed that developing country economies follow a long-term growth path towards industrialization and higher standards of living – and that political institutions remain stable enough to permit development over the long run. As this is a long run forecast analysis, short-term business cycle fluctuations are not modeled here.
- World demand for agricultural products and food products will remain high. There will be a steady increase in global agriculture demand due to increasing population and increasing affluence.
- Real energy prices that increase mildly through 2020 and improvements in efficiency in the use of raw materials lead to a reduction in overall energy demand

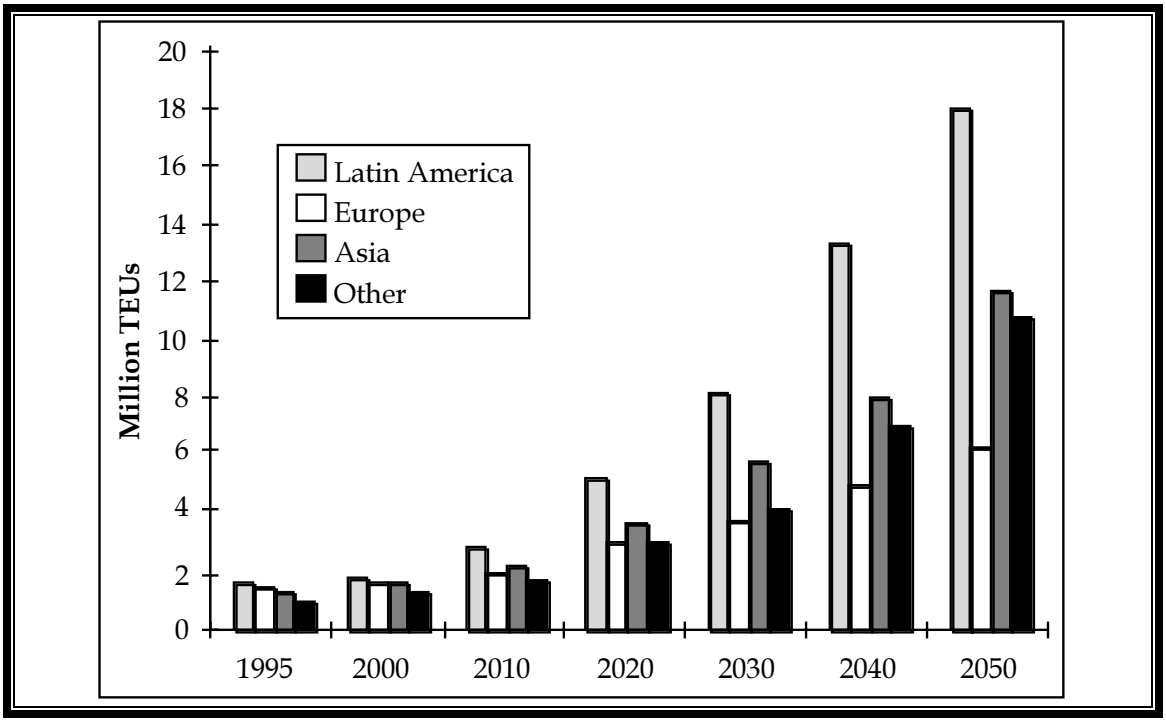
per dollar of output over time. This is a continuation of the energy efficiency trend observed today. Though individual real energy commodity price indices are used for imports and exports of crude petroleum, coal, natural gas, and refined petroleum products, the average annual increase in these series is 2.7 percent through 2020. This is consistent with long-term commercial energy price forecasts used by the U.S. Department of Energy.

- Revolutionary fast cargo vessel design technologies are prevented from capturing any significant share of the market due to the real energy price increases forecast and the high capital cost of such ships.

For the purposes of this study the definition of the South Atlantic Port region includes Norfolk. This is consistent with the definition used for the South Atlantic in previous regional trade studies performed for the U.S. Army Corps of Engineers.

The ICF trade forecast indicated that containerized trade through the South Atlantic port range increases with all foreign trade partner regions, though at different rates. While the volume of trade with Europe is still growing (and triples through 2020), the share of trade with Europe through the South Atlantic shrinks, dropping from the second largest in the region to fourth. Correspondingly, faster growing trade with other regions results in Latin American trade growing to over 19 million TEU by 2050 – compared with European trade of roughly 6 million TEUs over the same time period. Asian trade through the South Atlantic port range overtakes European trade volumes by 2010 and grows to over 10 million TEU by 2050. The levels of South Atlantic container trade by foreign trade partner regions are presented graphically in Figure 7-3.

Figure 7-3 South Atlantic Port Range Containerized Trade by Partner Region (in Millions of TEUs)

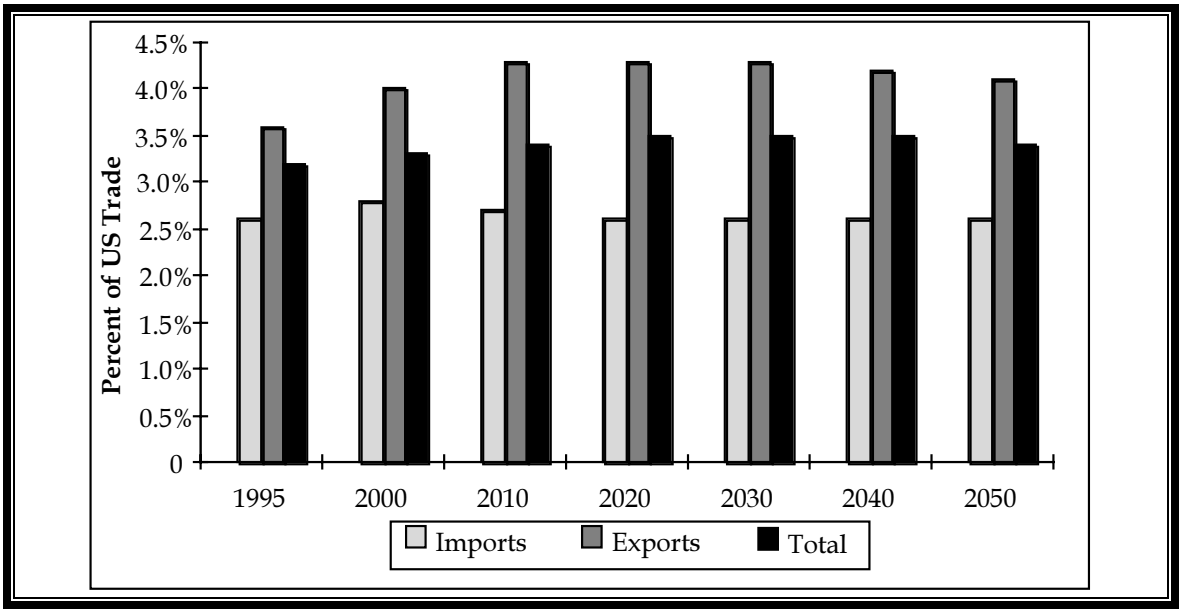


Source: ICF Kaiser Global Trade Forecast, 1997

From 2000 to 2050, the South Atlantic region's share of U.S. exports will increase while the share of U.S. imports decreases. The forecast shares reflect the differences between the U.S. import supplier regions and export markets, and the geographic proximity of the South Atlantic to these markets. Savannah Container Forecast

Savannah's container trade growth is estimated to average 4.8 percent per year in TEUs over the study period. Savannah's share of the country's container trade reflects the South Atlantic's advantage and geographic proximity to support this trade. Over the forecast period, Savannah increases its share of total U.S. imports and exports. The increase reflects a small loss of share from the Great Lakes and North Atlantic port ranges. Savannah's container trade shares, represented as percent of total U.S. TEU volumes, are presented in Figure 7-4.

Figure 7-4 Savannah Containerized Trade as a Share of U.S. Total Percentage of TEUs



Source: Booz·Allen analysis and ICF Kaiser Trade Forecast, 1997

7.3.2. Fleet forecast

7.3.2.1 Overview

The Port of Savannah is a major port on the East Coast of the United States, serving three main trade lanes between the U.S. and its foreign trade partners. Historical vessel call statistics place Savannah in the top tier of U.S. ports serving foreign trade. According to the Georgia Ports Authority (GPA) and Savannah Pilot Association data, over 2,100 vessels – including almost 700 containerships – called the Port in 1996. Figure 7-5 presents by type, the number of cargo vessels that entered Savannah in 1996.

55 percent of these vessels were either containerships or general cargo ships. Port calls Over by other vessel types account for the remaining 45 percent. Due to the relocation of GPA's grain handling capability to the Port of Brunswick in 1996, it is expected that the number of dry and liquid bulk vessel calls will decline, and the share of vessels that are containerships will increase. In addition, GPA has improved the automobile import/export facilities in Brunswick. This will impact the number of Ro/Ro vessels calling the Port. According to GPA data, Europe, the Far East (via the Suez Canal or Panama Canal), and South America are the primary overseas trade partner origins/destinations, accounting for over 90 percent of the nearly 700 containerships calling Savannah in 1996.

Figure 7-5 Number of Vessels by Type Calling the Port of Savannah in 1996

Number of Vessels by Type Calling the Port of Savannah in 1996

Design Draft	Container	General Cargo*	Roll-on / Roll-off	Tanker	Bulker	Barge**	Total
<38	326	456	160	160	259	139	1,500
38	62	14	6	29	10	9	130
39	58	21	25	7	10	0	121
40	116	27	0	24	1	5	173
41	0	1	0	11	1	11	24
42	96	1	0	7	9	0	113
43	25	0	0	4	1	0	30
44	0	0	0	4	1	0	5
45	0	0	0	1	0	0	1
>45	0	0	0	2	3	0	5
Total	**683**	**520**	**191**	**249**	**295**	**164**	**2,102**

Source: Savannah Pilots Association Logs, Georgia Ports Authority
Note (*): Includes semi-containerships and combination general cargo/semi-containerships.
Note (**): Includes integrated tug-barges.

Over 55 percent of these vessels were either containerships or general cargo ships. Port calls by other vessel types account for the remaining 45 percent. Due to the relocation of GPA's grain handling capability, it is expected that the number of bulker vessel calls will decline, and containerships serving the Port will become more prominent.

Europe, the Far East (via the Suez Canal or Panama Canal), and South America are the primary overseas origin/destination points which accounted for over 90 percent of the nearly 700 containerships calling Savannah in 1996.

In this study, economic development benefits accrue to consumers and producers of goods alike. Competition, through the price mechanism, is how benefits are distributed, but original cost savings comes from vessel operators' ability to use vessels more efficiently. Efficiency is improved by spreading fixed costs over larger volumes of cargo, thereby lowering the unit costs of cargo transportation. With increases in trade, sufficient demand exists to fill even larger vessels while maintaining service frequency. Vessel operators achieve the highest impact on costs when they operate large vessels on high volume trade lanes, such as the Europe to Far East, and the emerging markets between Southeast Asia and the United States. As vessel capacity increases, physical dimensions of the vessels increase. Therefore fleet forecasts detailing vessel size and frequency of port call becomes the basis for forecasting cost saving benefits and ultimately, the selected NED plan alternative project depth for the Savannah Harbor Expansion Study.

The world container fleet forecast uses a methodology where the supply of TEU transportation capacity in the world fleet is equal to the world demand of TEU container movements. This methodology is implemented through a Booz·Allen

forecast model which incorporates supply trends in vessel size, number, deployment strategy, capacity, construction/scrapping trends, and utilization to estimate world fleet capacity and fleet mix which is then balanced against commodity transportation demand forecasts.

The demand for TEU transportation capacity is forecast using the following inputs:

- Forecast of world general cargo trade tonnage.
- Forecast of general cargo tonnage expected to be moved via container.
- Forecast of containership utilization.
- Historic yearly world container capacity.
- Forecast of average slot utilization.

The supply side of the forecast contains several analytical steps, including an iterative step to model the scrapping or retirement of old vessels, replacing them with new vessels, and adding new fleet capacity to meet demand. The supply of TEU capacity on vessels in the world fleet forecast is determined using the following inputs:

- Historic and forecast orderbook of vessels and total capacity, by draft class (<38' to >46').
- Forecast of average capacities of vessels in each draft class.
- Forecast of the retired and replacement fleet, based on a 20-year vessel life span.
- Forecast of the additional capacity required after retirement and replacement, to meet demand.

The purpose of the world fleet forecast is to develop a baseline from which the Savannah fleet forecast can be developed. One assumption applied in the Savannah forecast is that the Savannah fleet is a microcosm of the world fleet. It is projected that as trade volumes increase through Savannah and the port grows to accommodate the increased traffic and trade over the study period, the Savannah fleet will evolve to more closely resemble the world fleet in terms of fleet mix. Fleet mix is the distribution of ships and capacity across design draft categories (e.g., 40 ft., 42 ft., 44 ft., etc.).

The Savannah fleet forecast is similar to the methodology used to develop the world fleet forecast, in that it uses a trade forecast to determine the demand for TEU transportation, then calculates the required vessel supply and fleet mix needed to meet demand. The model evaluates trade and vessels serving the Europe-North America, Latin America-North America, and the Asia-North America trade lanes separately. This approach mirrors the general deployment of containerships on rotations serving North America.

The supply of TEU capacity in the Savannah fleet forecast is determined using the following major inputs:

- Historical vessel calls to the port of Savannah, including total capacity and capacity distribution, by draft class (<38 ft. to >46 ft.).
- Forecast of average capacities of vessels in each draft class, based on historical trends.
- Forecast average TEU lifts per draft category.
- Forecast of the number of ships required to handle the forecast TEU trade levels based on TEU lift forecast.
- Expected number of additional ships deployed on the Savannah trade lanes over the study period.

Details of the methodology for determining the supply of TEU capacity are presented in the Economic Appendix.

The last ten years have seen dramatic changes in the size and capacity of the fleet calling Savannah, which have mirrored those changes experienced in the world fleet. Liner operators serving the Port have been steadily increasing their level of service over the last several years – and since the last deepening project – through a combination of operating larger, higher capacity vessels and increasing the number of port calls and services to the Port. Figure 7-6 presents the number of containership calls by draft, at GPA facilities over the last ten years.

Figure 7-6 Distribution of Containership Calls at Savannah by Design Draft Category, 1988 and 1996

Fleet Category by Design Draft in Feet and (Vessel Type)	1988 (38 Ft. Channel)		1996 (42 Ft. Channel)	
	Ships	% of Total	Ships**	% of Total
Unconstrained Fleet	143	29.7%		
Constrained Fleet:				
34 Feet (Handy)	13	9.8		
35 Feet (Handy)	38	7.9%	326	47.7%
36 Feet (Sub-Panamax)	58	12.0%		
37 Feet (Sub-Panamax)	40	8.3%		
38 Feet (Sub-Panamax)*	63	13.0%	31	4.5%
38 Feet (Panamax)*	62	13.0%	31	4.5%
39 Feet (Panamax)	58	12.0%	58	8.5%
40 Feet (Panamax)	7	1.5%	116	17.0%
41 Feet (Post-Panamax)	0	0.0%	0	0.0%
≥42 Feet (Post-Panamax)	0	0.0%	121	17.7%
Subtotal	339	70.3%	357	52.3%
Total	**482**	**100.0%**	**683**	**100.0%**

Sources: 1988 data from Table 32, USACE Savannah Harbor Georgia, Comprehensive Study, Appendix A, Revised, March 1992; Table B-3, USACE Savannah Harbor Georgia, Reconnaissance Report, July 1996; GPA and Savannah Pilots Association vessel call data for 1996; Booz·Allen analysis

Note (*): Assumed that one-half of the vessels identified with a draft of 38 feet are classified as Panamax vessels

Note (**): Excludes 219 unconstrained containerships and 58 constrained containerships serving other facilities at the Port of Savannah

The number of containerships calling GPA facilities grew from 482 vessel calls in 1988 to 683 in 1996 – an average annual growth of 4.5 percent. The use of larger (greater than 37 foot draft) containerships by the carriers serving Savannah increased dramatically during this period. Specifically, the Port of Savannah experienced significant growth in the use of Panamax and Post-Panamax vessel – increasing from 127 vessel calls (26 percent of the Savannah fleet) in 1988 to 357 vessel calls (52 percent of the Savannah fleet) in 1996. This rapid growth in the use of Panamax and Post-Panamax vessels and the percentage of deployed fleet capacity is consistent with world fleet trends.

7.3.2.2 World and Savannah Fleet Forecast Results

This section presents a summary of the world and Savannah fleet forecasts. The details of the forecast methodology are presented in Attachment C of this document and a compilation of spreadsheet printouts provided by upon request. Figure 7-7 presents the number of vessels, by design draft category, from the world fleet forecast.

Figure 7-7 World Containership Fleet Forecast, 2000-2050

Number of Fully Cellular Vessels by Draft Category

Design Draft (ft)	Forecast Study Period					
	2000	2010	2020	2030	2040	2050
<38	1,925	2,798	3,246	3,384	3,348	3,175
38	209	382	473	514	621	718
39	124	140	141	156	175	198
40	113	145	63	165	192	216
41	22	28	31	31	31	34
42	159	312	392	486	590	683
43	111	173	205	242	290	332
44	8	7	6	5	5	4
45	55	72	81	97	116	130
46	47	121	195	260	321	373
>46	11	18	22	25	31	35
Total	**2,784**	**4,196**	**4,955**	**5,365**	**5,720**	**5,898**

Source: Booz·Allen's World Containership Fleet Forecast Model (WCFFM)

The exhibit shows that the number of containerships in the world fleet will increase by over 210 percent over the study period. Following recent trends, it is expected there will be significant growth in the number of deep draft containerships during the first half of the next century. Projections estimate the needs for almost 1,600 Post-Panamax vessels in the world fleet, a 400 percent increase over today's levels. The results of the Savannah fleet forecast were aggregated across the three major trade lanes serving Savannah, Europe/Mediterranean, Latin America, and the Far East. It is expected that current and future carriers serving the Port will optimize the deployment of their vessels across trade lanes to maximize service and minimize costs. For international carriers and those operating as part of global alliances, operating deeper draft, high capacity container vessels will be an important part of their deployment strategy, provided that there is adequate water depth to access ports served by the carriers. The size of the Savannah Fleet and the number of Post-Panamax containerships forecast to call the Port will increase depending on the selected alternative deepening project.

7.3.2.3 Conclusions

In conclusion, the Savannah fleet forecast predicts that:

- Due to increased trade with developing markets, vessels with design drafts will continue to increase
- However, because of increased trade with major trade partners in the Far East, deep draft vessel calls will increase by over 445 percent

- The first Post-Panamax II vessel, with a capacity equal to or greater than 6000 TEUs, will call Savannah within the next decade if the channel is deepened to 46 feet in depth or greater
- These second-generation Post-Panamax vessels are not expected to be placed in services calling Savannah unless the channel depth is increased to over 44 feet MLW.
- Overall, vessel calls will increase by over 530 percent, averaging almost 4 percent per year.

To complete this chapter, a short discussion is presented on the methodology and results of forecasting the liquid and dry bulk vessel fleet calling the Port of Savannah.

7.3.2.4 Savannah Liquid and Dry Bulk Fleet Forecast

The initial work of the fleet forecast and benefits study for the Savannah Harbor Expansion Project focused only on containerized cargoes. After preliminary analysis was completed, direction was given to examine if any non-containerized cargo benefits would accrue to any of the alternative deepening projects. Results of forecast and benefits analysis shows that some benefits accrue from these vessels. However, no benefits accrued from bulk vessels is counted in the analysis. Data presented on non-containerized vessel forecasts is provided for information only. If cost estimates are completed in the future for these bulk cargo berths, the information provided herein will assist in reincorporating the benefits accruing from non-containerized cargo.

7.3.2.5 Non-containerized vessels

Non-containerized vessels consist of liquid bulk tankers (oil product carriers, crude oil tankers, chemical tankers, integrated tug-barge vessels, etc.) and dry bulkers (ore carriers, wood chip, gypsum, etc.). General cargo and vehicle carriers are not included since these vessels presently are not draft constrained vessels and are not expected to become draft constrained over the study period.

A fleet forecast of tankers and dry bulkers was developed using the forecast of non-containerized cargo tonnage, and data on the number of these vessel calls, by draft, at the Port of Savannah during 1996. A key assumption in this analysis was that due to the relative maturity (regarding technology and size) of the tanker and dry bulk, relatively slow growth projected in the Savannah bulk trades, and facility and distribution system capacity limitations, the size and mix of tanker and dry bulker vessels serving the Port of Savannah over the study period would remain constant.

The relationship between vessel distribution, number of vessel calls in the base year, and the non-containerized cargo forecast was utilized to forecast the number of vessel calls that tankers and dry bulkers will make to the Port of Savannah over the study period. Figure 7-8 and 7-9 present the results of the non-containerized forecast in vessels calls by design draft category for the study period.

Figure 7-8 Forecasts of Tanker Vessel Calls to the Port of Savannah

Design Draft (ft)	2000	2010	2020	2030	2040	2050
<38	177	211	210	285	325	364
38	30	36	36	49	56	62
29	0	9	9	13	14	16
40	26	31	31	42	48	53
41	12	15	14	19	22	25
42	8	9	9	13	14	16
43	5	6	6	7	8	9
44	5	6	6	7	8	9
45	2	2	2	2	2	3
>46	3	3	3	4	4	5
Total	**271**	**323**	**322**	**437**	**497**	**557**

Source: Georgia Ports Authority, Savannah Pilots Association, and Booz·Allen analysis

Figure 7-9 Forecast of Dry Bulk Vessel Calls to the Port of Savannah

Design Draft (ft)	2000	2010	2020	2030	2040	2050
<38	281	366	452	542	634	731
38	21	27	34	40	47	54
29	11	15	18	21	25	29
40	7	9	11	13	15	17
41	14	17	22	26	30	34
42	10	13	16	19	23	26
43	2	2	2	3	3	3
44	2	2	2	3	3	3
45	–	–	–	–	–	–
>46	13	15	18	22	24	27
Total	271	323	322	437	497	557

Source: Economic Appendix

7.4. Net Benefits

The benefit/cost analysis is the final step in the economic analysis of the feasibility study, following commodity forecasting and fleet forecasting which were addressed above. In the benefit/cost analysis, a systematic approach is used where all benefits (reductions in transportation cost) from the channel deepening are aggregated, all costs associated with the channel deepening are aggregated, and the difference between these two sums equals the net benefits. The benefits and costs are determined for the baseline without project condition, and several with project condition channel deepening scenarios.

Economic benefits of harbor deepening are accrued through lower transportation costs and hence lower prices for the goods transported. The total cost of transporting projected traffic over the study period was computed for the without project condition (42 foot channel depth), and for 44-, 46-, 48-, and 50-foot with project condition channel depth alternatives. Total net transportation costs includes vessel operating costs, ship beam-channel width delay costs due to one-way traffic in the channel, and tidal delays. Each of these is discussed in turn.

7.4.1. Vessel Operating Costs

Total vessel operating costs for projected traffic over the study period was computed for the 42-foot without project condition channel, and the alternative with project conditions of 44-, 46-, 48-, and 50-foot channel depths. The scope of this effort included the benefits that would accrue through the operation of containerships, in addition to liquid and dry bulk vessels.

The methodology for calculating benefits from containership traffic and bulk vessels is essentially identical. Vessel operating costs were developed for each draft category using NED Guidelines, an IWR memorandum on FY97/98 Vessel Operating Costs, and average vessel deadweight. The methodology utilized to calculate annual vessel operating costs is the product of the following items for each vessel draft category:

- trade route cargo tons
- trade route distance
- at-sea vessel operating costs per ton-mile
- fleet distribution by draft increment
- light loading distribution by draft increment

Trade route cargo tonnage was taken from the trade forecast. Trade route distances were developed for each trade lane from marine distance tables and incorporated multiple ports of call representative of current and future container carrier service patterns. Trade routes for bulk cargo operations were determined by the type of commodity being moved and the origin or destination of the commodity. Vessel operating costs per ton-mile (US$/ton-mile) and vessel operating costs per hour at-sea and in-port (US$/hour), were calculated for containerships, tankers, and dry bulkers, based on information detailed in the USACE FY97/98 Vessel Operating Costs Memorandum. Fleet distribution was taken from the fleet forecast.

Vessel light loading occurs when ships are not loaded to their optimum design draft. Curves representing the distribution of light loading of containerships, tankers, and bulkers were developed from historical data provided by the Georgia Ports Authority and Savannah Pilots Association. The data was segmented by design draft and operating draft to determine the degree of light loading for each vessel and vessel class at upon arrival and departure from the Port. For without project conditions, it was

assumed that the vessel light loading distribution for each vessel class will remain constant over the study period. For each with project condition scenario, it was assumed that a number of deep draft vessels would transition from constrained status to unconstrained status. Unconstrained operations for a vessel occurs when available water depth exceeds a vessel's operating draft plus four feet for under keel clearance. For with project conditions, it was assumed that constrained vessels transitioning to unconstrained status would take on the operating characteristics of unconstrained vessels under without project conditions.

After calculating annual operating cost for each vessel draft category, total annual operating cost for the fleet was developed by summing the components.

7.4.2. Tide Delay Costs

The methodology for calculating tidal delay costs was similar to that utilized in calculating vessel operating costs and is different in that it integrates Savannah's natural tide cycle. Costs were determined for constrained vessels subject to tidal delays and considered how long they would be delayed and in-port operating costs impacts under both without project and with project conditions. The methodology utilized to calculate annual tidal delay costs is the product of the following items for each vessel draft category:

- in-port vessel operating costs per hour.
- probability of delay.
- length of delay, in hours.
- fleet distribution to the draft increment.
- light loading distribution to the draft increment.

Annual tidal delay costs were calculated by vessel draft category and aggregated to determine total costs for each project alternative.

7.4.3. Ship Beam/Channel Width Delay Costs

Channel designs for without and with projects conditions in the feasibility study maintain existing channel side slope angles, resulting in narrower effective channel width at the bottom of the channel. This in turn results in a potential situation where two or more vessels operating laden may no longer have sufficient clearance to meet or pass in some sections of the channel. The frequency of incidence of this beam conflict and delays occurring was estimated through the use of a vessel traffic simulation model which is detailed in Appendix C. Subsequently, all costs of delay were calculated from the results for both without and with project conditions for each alternative.

7.4.4. Federal Discount Rate

The Federal Discount Rate used in the analysis to develop annual average costs was taken from the Vessel Operating Costs memorandum published by the IWR. The current discount rate is 7 1/8% (7.125%). This rate is used throughout this study to discount all future benefits and costs to reflect the time value of money.

7.4.5. Benefits

Benefits were calculated for the initial harbor expansion alternatives. The methodology for calculating total transport costs was to sum containership, tanker, and dry bulk vessel transport costs, tidal delay costs, and ship beam/channel width conflict delay costs, for each year, by alternative project. Figure 7-10 presents the transportation, tidal delay, and beam conflict delay costs for the Without Project Condition and the With Project alternatives

Figure 7-10 Initial Alternatives, Preliminary Benefits

PROJECT DEPTH	OPERATING COSTS	TIDAL DELAY COSTS	BEAM WIDTH DELAY COSTS	TOTAL COSTS
42′	$125,100,000	$1,770,000	$0	$126,900,000
44′	115,200,000	640,000	620,000	115,900,000
46′	108,200,000	100,000	620,000	108,400,000
48′	106,700,000	10,000	620,000	106,800,000
50′	106,100,000	0	620,000	106,200,000

Source: Economic Appendix.

The average annual equivalent benefits for each alternative are shown in Figure 7-11.

Figure 7-11 Initial Alternatives, Average Annual Benefits

ALTERNATIVE	AVERAGE ANNUAL BENEFITS
44′	$10,931,000
46′	18,461,000
48′	20,115,000
50′	20,715,000

Source: Economic Appendix.

7.5. Multiport Analysis

Savannah is measured against its competitor ports in terms of landside (including port) infrastructure and competitive cost position. Competitive costs are the transportation costs for cargoes shipped to/from Savannah Harbor's competitive hinterlands through Savannah and competing ports to/from oversee trade partners. The objective of this multiport analysis is to assess the potential for the with project condition alternatives to affect traffic through competing ports (e.g., cargo diversion).

As one of North America's top container ports, Savannah Harbor has shown to be the choice of many shippers as the entry/exit point to the U.S. for their import and export goods. The evidence to support this conclusion is the volume of containers that shippers retain ocean carriers to ship through the port each year. In order to be selected as the port of choice, each shipper (or their agent) must have decided to use Savannah over its competitor ports, given the combination of cost and service available from the port. Inland distribution statistics from the Journal of Commerce PIERS data show that Savannah serves markets that overlap with other U.S. container ports. This multiport analysis analyzes the effect that deepening the Savannah Harbor navigation channel may have on cargo volumes through Savannah and competitor ports.

7.5.1. Infrastructure

The landside, port, and waterside infrastructure contributes significantly to the service and operational competitiveness of a container port. As U.S. trade volumes have increased, carriers have demanded modern equipment and adequate space to match their own significant investments in vessels and management systems. As shippers pressure carriers for competitive rates with high quality service, carriers look to ports for commitment in providing required infrastructure to make low cost efficient service possible. During the last several decades, Savannah and competitor ports have addressed this need through investments in infrastructure to keep up with the increased size of trade and vessels. The infrastructure of Savannah and its competitor ports is an important measure of competitiveness, especially for containerized cargoes.

The infrastructure characteristics are summarized for Savannah and it's competitor ports in Figure 7-12. Data has been aggregated across all container terminals in a port for a composite picture of each port.

Figure 7-12 Port Infrastructure Characteristics in 1997, South Atlantic Port Range Container Ports

Port Characteristic	Savannah GA	Wilmington NC	Charleston SC	Hampton Roads VA	Jacksonville FL
Number of Terminals	2	1	3	3	2
Berths:					
- Number	7*	9	9	11	9
- Total Length (ft.)	7,501	6,768	7,940	12,250	8,737
Container Crane					
Number:	12	5	18	18	9
- Total	4	o	8	3	1
- Port Panamax (=145')					
Available Water Depth:					
- Channel	42	40	40 - 45	50	38
- Berth	42	40	40	35 - 45	38
Paved Acreage	470*	100	451	872	739
Storage (TEU)	24,042	65,000**	26,000	48,268	5,100
No. of Class 1 Railroads	2	2	2	2	2

Source: Containerization International Yearbook, 1997

Note (*): Includes new container berth #7 currently under construction and does not include multiple general use berths located at Ocean Terminals

Note (**): Included unpaved acreage

In general, the exhibit shows that the Port of Savannah is relatively comparable or advantaged to other ports in the South Atlantic. The Port of Savannah maintains the longest contiguous dock of ports in the South Atlantic, with most all container facilities and capacity concentrated at its Garden City terminal.

7.5.2. Delivered Transportation Cost

Shippers make decisions based on service and more importantly, price (i.e., cost) of transportation. Thus, to determine the competitive position of routing cargoes through the Port of Savannah and its competitor ports, a comparison of total transportation costs incurred by shippers transporting cargoes between the Savannah hinterlands and various overseas trade regions was conducted. Under various project deepening alternatives, maritime costs will vary according to operating and fleet deployment alternatives ocean carriers may consider. Total transportation cost was developed by combining marine, port, and landside transportation costs for each hinterland city, port, and trade region combination. For the Rotterdam trade, Figures 7-13 and 7-14 present a summary of total transportation cost to serve the Atlanta and Rotterdam markets.

Figure 7-13 Total Transportation Costs per Container
(Rotterdam to Atlanta via Various U.S. Ports)

S. Atlantic Port	Marine	Port	Landside	Total
Norfolk	$656	$237	$525	$1,418
Charleston	$700	$201	$294	$1,194
Savannah	$722	$213	$250	$1,185
Jacksonville	$723	$207	$316	$1,246

Source: Economic Appendix

Figure 7-14 Total Transportation Costs per Container
(Rotterdam to Memphis via Various U.S. Ports)

S. Atlantic Port	Marine	Port	Landside	Total
Norfolk	$656	$237	$520	$1,413
Charleston	$700	$201	$530	$1,431
Savannah	$722	$213	$509	$1,443
Jacksonville	$723	$207	$518	$1,448

Source: Economic Appendix

The exhibits highlight that for the Atlanta market, Charleston and Savannah are significantly advantaged to Norfolk and Jacksonville. On the other hand, all ports are found to be cost competitive in serving Memphis, with Norfolk having the lowest total transportation cost.

Similar calculations were completed for other trade routes, including Asia, which requires vessels calling directly to East Coast ports to transit either the Panama Canal or Suez Canal. A summary the analysis is presented in Figure 7-15.

Figure 7-15 Comparisons of Total Transportation Costs per Container
(Singapore to Atlanta via Various U.S. Ports)

U.S. Port	Marine	Port	Landside	Total	Rank
Los Angeles	$1,418	$268	$1,070	$2,757	2
New York	$2,200	$368	$670	$3,238	7
Norfolk	$2,227	$237	$551	$3,014	5
Charleston	$2,270	$201	$294	$2,764	3
Savannah(Panama)	$2,586	$213	$250	$3,049	6
Savannah(Suez)	$2,292	$213	$250	$2,755	1
Jacksonville	$2,293	$207	$316	$2,816	4

Source: Economic Appendix

The figure shows that serving Savannah via the Suez Canal is advantaged to the Panama Canal routing, and is cost competitive to a mini-landbridge service via Los Angeles or all water service through Charleston.

The examination of competitive infrastructure and cost factors shows that today, Savannah is a competitive port in the context of both maritime infrastructure and the total transportation costs, and that it does not incur any significant disadvantage or advantage over its port competitors. More important, with current facilities and costs, Savannah is not in a position to gain significant advantages versus its competitor ports by providing incremental infrastructure or significantly lower maritime transportation costs under various with project deepening scenarios.

7.6. Risk and Uncertainty Analysis

As part of the analysis to determine the NED benefits of a harbor deepening project, an assessment of the risks and uncertainty of the assumptions and cost estimates utilized in the analysis is required. The objective of risk and uncertainty analysis is to identify assumptions and calculations that are critical to the overall benefits and costs of competing project alternatives, and their impact to the preferred project alternative. Risk and uncertainty analysis was completed against the following essential elements of the NED analysis:

- commodity forecast.
- fleet forecast.
- transportation costs.
- net benefits and project costs.

The risk and uncertainty analysis demonstrated that the assumptions utilized in the NED analysis were reasonable and consistent with historic and current practices and forecasts. Additionally, the analysis identified little impact to the NED plan and benefit-cost analysis. An in-depth overview of the risk and uncertainty analysis is presented in Appendix A.

7.7. Analysis Of Initial Alternatives

The Engineering Appendix contains detailed information on existing harbor conditions and engineering requirements for harbor expansion alternatives.

7.7.1. Channel Depths

The primary difference in the harbor expansion alternatives is the resulting channel depth. Project depth without advance maintenance is constant from Station 103+000 to Station –14+000B in the entrance channel. From Station –14+000B to the end of the entrance channel in the ocean, the channel is 2 feet deeper than project depth. Areas where 2 or 4 feet of advance maintenance is currently authorized will remain the same.

Figure 7-16 shows the channel depths in the inner harbor and entrance channel for the harbor expansion alternatives without advance maintenance.

Figure 7-16 Initial Alternatives, Channel Depths

STATION	42′ Base Condition	ALTERNATIVE			
		44′	46′	48′	50′
103+000					
	42	44	46	48	50
-14+000B					
	44	46	48	50	52
End of entrance channel					

Source: Engineering Appendix.

7.7.2. Channel Widths

Since the existing channel sideslopes of 1V: 3H are maintained for all of the alternatives, the upper channel width is identical, except for wideners. The channel bottom widths are smaller than the existing channel, and the widths vary in reaches with advance maintenance.

7.7.3. Channel Alignment

All of the harbor expansion alternatives would include ten wideners in the inner harbor and two in the entrance channel, as described in the Engineering Appendix.

7.7.4. Slope Stability and Real Estate Requirements

The soils analysis identified six areas where there are potential problems with channel side slopes, sloughing of materials, or real estate acquisition requirements.

7.7.5. Turning Basin Improvements

All of the initial harbor expansion alternatives include deepening and widening of Kings Island Turning Basin, located at Station 100+000 (RM 18.9). The dimensions would be increased as shown in Figure 7-17. The depth would be increased to the project depth associated with each alternative.

Figure 7-17 Initial Alternatives, Kings Island Turning Basin Improvements

	DIMENSIONS (ft)
Current	42′ x 1,500 x 1,600
With Project	44′-50′ x 1,500 x 1,676

Source: Engineering Appendix.

7.7.6. New Work Dredging Requirements

All dredging costs were developed using the Cost Engineering Dredge Estimating Program (CEDEP). For programming purposes, it was assumed that all maintenance material, all new work material from the proposed project depth plus advance maintenance, and all allowable overdepth will be removed. For comparison purposes, large class hopper dredges, 30 inch pipeline dredges were utilized to prepare the cost estimates. Mobilization costs for two large class hoppers and two 30" pipeline dredges have been included. All plant mobilization distances were assumed to be 1,000 miles.

Quantity computations for the project alternatives include volumes from the required dredging prism and 2 feet of allowable overdepth below the expansion prism. The required dredging prism for the expansion project is defined as the cross-sectional area between the allowable overdepth prism for the existing project and the depth of the alternative in the inner harbor and entrance channel. The required dredging prism includes recreation of advance maintenance.

7.7.7. Disposal Requirements

Disposal area requirements include constructing improvements to disposal areas 12A and 14B prior to the harbor expansion project. Detailed information on disposal area improvements required for each alternative are included in the Dredged Material Management Plan in the Engineering Appendix.

7.7.8. New Upland Disposal Area

Dredged material from Stations 103+000 to 79+000 would normally be pumped to disposal area 2A but this disposal area will not be available for use after Fiscal Year 1999. The material would be pumped a longer distance to disposal area 12A downstream. The study evaluated whether it would be more cost-effective to create a new disposal area closer to the dredging area instead of pumping to 12A. The new area would have to be of sufficient size to accommodate approximately 8 million cubic yards, and it would have to be near the dredging area. The only option currently identified would be to combine disposal areas 1N and 1S, upstream of the dredging area, and encompass marshland between the two sites. The new area would require extensive dike and weir construction, and the estimated construction cost is $3,800,000. In addition, 570 acres of upland and 300 acres of marshland would be acquired at a cost of approximately $8,850,000. These high costs for a new disposal area greatly exceed the additional pumping cost to disposal area 12A, which are estimated to be $ 4,030,000; therefore, it is not cost-effective to construct a new disposal area.

7.7.9. Debris Removal

Construction of wideners will require the acquisition of real estate on the north bank of the river because the top of slope line is landward of the existing mean low water line. The riverbanks in these areas contain debris that will require removal prior to commencement of dredging to prevent damage to the dredge. Types of debris include

timber and concrete piles, lumber, wooden vessel hulls, riprap, concrete, abandoned pipe, miscellaneous scrap metal, trees, and other vegetation. Removal of 350 linear feet of bulkhead will be required between Stations 78+140 and 77+261.

7.7.10. Cultural Resources

There are two major cultural resources in the inner harbor, which are listed in the Historic Register and which would be impacted by a harbor expansion alternative. Old Fort Jackson is located at Stations 58+000 through 59+000. The CSS Georgia is located across the river from Old Fort Jackson on the north slope of the channel.

7.7.11. Old Fort Jackson Cultural Resources Mitigation Plan

The engineering analysis indicated that channel deepening for any depth would impact the moat parallel to and closest to the river channel and the moat tunnel structure. Impacts would result from losing 4 to 10 feet of soil directly adjacent to the tunnel sheet piling and the existing protective timber wall adjacent to the moat structure. These materials contribute directly to the lateral support for both the piling and the timber wall, which in turn protects the foundation for each structure. Loss of these materials could result in degradation of supporting wall foundations and could result in stability problems.

Several options for protecting Old Fort Jackson were considered, including moving the south channel toe alignment away from the fort and construction of a system to protect the supporting riverbank materials. Protective systems investigated included sheet piling or a flexible mattress filled with concrete. Project costs of the harbor expansion alternatives include construction of the protective system.

7.7.12. CSS Georgia Cultural Resources Mitigation Plan

The submerged wreck of the confederate ship CSS Georgia has been hit in the past by dredge cutterheads. Any amount of channel deepening would have a major impact on the wreck. It was concluded that the only feasible measure is to recover, document, and curate the items of historic significance. Project costs include preliminary estimates for removal of the vessel. Excavation and recovery costs will be refined during the engineering and design phase.

7.7.13. Natural Resources

7.7.13.1 Environmental Impact Statement

A Tier I Environmental Impact Statement was prepared for the proposed harbor expansion project. The document was distributed for review by interested Federal, state, and local agencies and the public. Comments received on the Draft Tier I EIS were taken into consideration, and the Draft Tier I EIS and this Feasibility Report were revised accordingly.

7.7.13.2 Groundwater Aquifer

A detailed investigation was conducted of the potential impacts of channel deepening on the Floridan aquifer, which is below the harbor channel and is a major source of domestic and industrial water supply. Results of the investigation are in the study *Supplemental Documentation* that is on file in the offices of the Savannah District and Georgia Ports Authority. The area of concern is the harbor entrance channel just north of Tybee Island, where the aquifer is at its highest elevation. The aquifer is generally at elevation –95 feet mean low water in this area, which is about 53 feet below the –42 foot current channel bottom depth.

The principal aquifer known as the Floridan aquifer, which is the largest source of fresh water in the coastal area, has received particular attention as state groundwater agencies have begun to search for alternative groundwater resources. Measures to relieve some of the stress on the Floridan aquifer have already been put into effect by state groundwater agencies in an attempt to force groundwater users to explore and develop alternative sources.

Due to concerns that deepening the existing Savannah Harbor channel might have potential impacts on groundwater aquifers below the channel, a study was initiated to evaluate the possible impacts. The principal objective of this investigation was to better characterize the geologic and hydrogeologic framework of the project area through the use of a sub-bottom geophysical survey, core drilling, borehole geophysical logging, permeability analysis of core samples, and test wells. The investigation provided the most comprehensive hydrogeologic evaluation of potential impacts of dredging to groundwater resources performed to date in Savannah Harbor.

Since previous studies have indicated that an area along the present navigation channel between approximate river stations 20+000 and –23+000 warranted particular attention, due to a general rise and thinning of sediments and the existence of buried relict stream channels, the major focus of the study was in this area of the navigation project. This portion of the channel lies roughly between the Intracoastal Waterway at Fields Cut and the area immediately offshore from Tybee Island.

Approximately 50 miles of sub-bottom geophysical surveying was performed along and across the centerline of the present navigation channel. The investigations included core borings, test wells, water quality analyses, and permeability and grain size analyses. Analysis of data from the study indicates sediments within the lower Miocene were consistently found to be more like confining materials than aquifer materials. The upper and lower Miocene sediments should be considered as confining materials for the Floridan aquifer below.

The thickness of the combined upper and lower Miocene confining units, below the proposed project dredging depth of –54 feet MLW in the study focus area, was found to range from about 50 to 60 feet, except in certain areas where relict stream channels have cut down into the Miocene to as deep as –73 feet MLW. In the remaining project area

the confining unit thickness below –54 feet MLW is generally greater than 60 feet, and in the upper reaches of the harbor is over 200 feet thick.

Due to the thickness and impermeability of the Miocene confining unit, and the impermeability of the in-filling sediments of the relict stream channels, analysis of data indicates that dredging to the maximum proposed project depth will have no noticeable impact on the quality and quantity of groundwater within the Floridan aquifer.

7.7.13.3 Environmental Impacts

The Draft Environmental Impact Statement evaluated the potential environmental impacts of the 50-foot expansion alternative.

In addition to the evaluation of environmental impacts, impacts to biological resources were evaluated using a calibrated hydrodynamic model that predicted changes to salinity and dissolved oxygen. These predicted changes due to a 50-foot expansion project were evaluated with respect to the species of concern and to resources of special significance, particularly the Savannah National Wildlife Refuge.

Direct impacts to wetlands due to construction were minimized by the selected channel design by extending existing side slopes to the proposed channel depths. The only wetlands areas impacted outside of the existing channel were at 6 bend wideners. These areas contain some amount of wetlands, which may be removed by the project.

In order to assess potential secondary impacts of salinity to freshwater marshes in the Savannah National Wildlife Refuge, a quantitative plant community study was conducted. The study showed that the existing boundary of the diverse freshwater plant community has not changed dramatically from removal of the tidegate structure as predicted by earlier studies. Modeling of projected salinity changes caused by the proposed deepening project indicate that changes in salinity, especially along the Little Back River, will be minimal and not approach the significant levels experienced through operation of the tidegate. Since there has been no significant change in vegetation since operation of the tidegate, the existing salt tolerant species are unlikely to change as a result of the expansion project. The potential impact of the project to future fresh marsh succession was also addressed. A potential zone of impact was identified and a characterization of existing vegetation within and adjacent to this zone was performed.

The Draft Environmental Impact Statement presented a study program to analyze the historic, present, and future salinity and marsh conditions in the refuge to confirm whether an impact to future marsh succession will be caused by the expansion project. The goal of the study was to develop more sensitive predictive tools and techniques. These will be used during the engineering and design phase, in conjunction with the historical and recently acquired data, to refine preliminary environmental mitigation measures.

Model simulations of dissolved oxygen changes and salinity changes under the proposed expansion project did not predict adverse impacts to striped bass spawning recovery efforts in the Little Back River and Back River, although an increase in salinity in the Middle River would likely cause a minor impact to the limited spawning that presently occurs there. As mitigation for this limited impact, a study of the hydrodynamic and water quality conditions associated with the restoration of the Back River to pre-Tidegate conditions will be performed during engineering and design. The decrease in dissolved oxygen levels within the Kings Island Turning Basin may affect the juvenile shortnose sturgeon and the Draft Environmental Impact Statement recommended a 3-year study that would monitor the recruitment of juveniles.

A study of the subsurface along the channel has shown that the Floridan aquifer will not be breached by the proposed action and that no threat to the groundwater sources of Savannah are posed by the project.

7.7.13.4 Natural Resources Mitigation Plan

A preliminary natural resources mitigation plan was developed in order to develop preliminary cost estimates for the initial harbor expansion alternatives. The plan was substantially revised during the evaluation of final alternatives.

7.7.14. Real Estate Requirements

At the time preliminary cost estimates were prepared for the initial harbor expansion alternatives, real estate requirements had not been completed. However, real estate requirements for the initial alternatives would include wideners and expansion of the Kings Island Turning Basin and would be identical for all of the alternatives.

7.7.15. Navigation Aids

Additional navigation aids would be required for all of the alternatives to mark the new channel, particularly extension of the entrance channel.

7.8. Preliminary Costs Of Initial Alternatives

7.8.1. Cost Items for Initial Alternatives

The preliminary cost estimates for the initial harbor expansion alternatives included the following cost items:

- Dredging costs
- Dredge mobilization and demobilization costs
- Debris removal
- Disposal area improvements
- Navigation aids
- Engineering and design

- Supervision and administration
- Environmental mitigation
- Cultural resources mitigation plan
- Environmental mitigation plan

7.8.1.1 Dredging Costs

Information from the 1994 Savannah Harbor deepening and the 1998 Brunswick Harbor Feasibility Report were used to develop unit costs for dredging.

7.8.1.2 Mobilization and Demobilization

Cost estimates for mobilization and demobilization assumed dredges would be located within a 1,000-mile radius. Costs were influenced primarily by the number of dredges used for each alternative.

7.8.1.3 Debris Removal

All alternatives would include removal of the same amount of debris.

7.8.1.4 Disposal Area Improvements

Preliminary data from the Dredged Material Management in the Engineering Appendix was used to estimate costs of disposal area for each alternative.

7.8.1.5 Navigation Aids

The cost of navigation aids for each alternative would vary according to the length of the extended entrance channel.

7.8.1.6 Engineering and Design

Preliminary cost estimates for engineering and design for each alternative were based upon actual experience from the 1994 Savannah Harbor Deepening plus information from the 1998 Brunswick Harbor Feasibility Report. Engineering and design costs include preparation of plans and specifications for each contract.

7.8.1.7 Supervision and Administration

Preliminary cost estimates for supervision and administration for each alternative were based upon the number of dredges, number of passes to obtain required depth, and resultant duration of supervision and administration. The change in number of dredges and passes is reflected in the breakpoint between 46-foot and 48-foot projects.

7.8.1.8 Lands and Damages

The real estate analysis was not complete when the preliminary costs of the initial harbor expansion alternatives were developed. However, real estate costs result primarily from wideners. Real estate costs are not substantial and would be identical for all alternatives.

7.8.1.9 Environmental Mitigation

Each initial alternative includes the same preliminary cost for an environmental mitigation plan, which was estimated to be $800,000 plus 30 percent contingencies for a total of $1,040,000.

7.8.1.10 Old Fort Jackson Mitigation

Each initial harbor expansion alternative would include the same cultural resources mitigation plan for Old Fort Jackson. It was initially assumed the cultural resources mitigation plan for Old Fort Jackson would be a concrete filled mattress to protect the structure. The preliminary cost was estimated to be $1,000,000 plus 10 percent contingencies for a total of $1,100,000.

7.8.1.11 CSS Georgia.

Each alternative would also include the same cultural resources plan for the CSS Georgia. The preliminary cost for excavation and removal of the vessel was $9,000,000 plus 35 percent contingencies for a total of $12,150,000.

7.8.2. Preliminary Cost Estimates for Initial Alternatives

Figure 7-18 presents the preliminary total project costs of the initial harbor expansion alternatives, plus the equivalent average annual costs of each alternative based upon a Federal interest rate of 7 1/8 percent and 50-year project life.

Figure 7-18 Initial Alternatives, Preliminary Cost Estimates, Total Project Costs

ITEM	Cont. (%)	ALTERNATIVE			
		44′	46′	48′	50′
Dredging	25	$44,656,000	$74,483,000	$101,055,000	$129,463,000
Mobilization	30	4,550,000	4,550,000	4,550,000	4,550,000
Debris Removal	30	1,950,000	1,950,000	1,950,000	1,950,000
Disposal Area Improvements	25	3,006,000	3,237,000	3,273,000	3,714,000
Navigation Aids		559,000	661,000	695,000	696,000
Engineering & Design		4,500,000	4,670,000	4,830,000	5,000,000
Supervision & Administration		3,100,000	3,100,000	6,200,000	6,200,000
Environmental Mitigation	30	1,040,000	1,040,000	1,040,000	1,040,000
Subtotal		**$63,361,000**	**$93,691,000**	**$123,593,000**	**$152,613,000**
PROJECT COSTS INCLUDING CULTURAL RESOURCES MITIGATION COSTS					
Old Fort Jackson Mitigation*	10	1,100,000	1,100,000	1,100,000	1,100,000
CSS Georgia Mitigation*	35	12,150,000	12,150,000	12,150,000	12,150,000
Total Project Costs		**$76,611,000**	**$106,941,000**	**$136,843,000**	**$165,863,000**

* Cultural Resources mitigation costs are project costs but are not included in the benefit/cost analysis.

Source: Engineering Appendix, Real Estate Appendix, Draft Tier I Environmental Impact Statement.

7.9. Benefits, Costs, and Major Impacts of Initial Alternatives

Figure 7-19 presents a summary of the benefits, costs, and benefit/cost ratio for each of the initial harbor expansion alternatives. The equivalent average annual cost for each alternative is based upon a Federal interest rate of 7 1/8 percent and 50-year project life. Each of the alternatives is economically feasible since they all have a benefit/cost ratio greater than unity.

Figure 7-19 Benefits, Costs, and Major Impacts of Initial Alternatives

	ALTERNATIVE			
	44'	46	48	50
Total project cost*	$63,361,000	$93,691,000	$123,593,000	$152,613,000
Project annual cost	4,664,000	6,896,000	9,097,000	11,233,000
Annual Benefits	10,931,000	18,460,000	20,115,000	20,715,000
Benefit/cost ratio	2.34	2.68	2.21	1.84
Net benefits	6,267,000	11,564,000	11,028,000	9,482,000
Environmental impacts	Least			Greatest
Environmental mitigation plan	1,040,000	1,040,000	1,040,000	1,040,000
Cultural resources mitigation plan	13,250,000	13,250,000	13,250,000	13,250,000

* Excluding cultural resources mitigation costs.

Source: Engineering Appendix, Economic Appendix, and Draft Tier I Environmental Impact Statement.

8. EVALUATION OF FINAL ALTERNATIVES

Based upon the evaluation of initial harbor expansion alternatives, Alternative 44 (deepen to -44'mean low water) was eliminated. It only captures approximately half of the benefits attainable under a 48 or 50 foot project. Alternative 44 would only result in a 2-foot harbor deepening and would not meet projected future needs.

The evaluation of the initial alternatives showed the National Economic Development (NED) Plan would have been Alternative 46 based upon preliminary benefits and costs. However, there was not a large relative difference in the average annual costs of Alternatives 46 and 48. The evaluation of final alternatives includes preparation of detailed MCACES and CEDEP cost estimates for each alternative. Since more detailed cost information might show the NED Plan to be between 46 and 48 feet, it was decided to include a 47-foot project as a final alternative.

In addition, since there is a change in cost sharing at the 45-foot depth, a detailed cost estimate was also needed for this depth. Therefore, Alternative 45 (deepen the inner harbor to 45 feet) was included for cost sharing computations.

The harbor expansion alternatives selected for final evaluation were:

- Alternative 46 (deepen inner harbor to 46')
- Alternative 47 (deepen inner harbor to 47')
- Alternative 48 (deepen inner harbor to 48')
- Alternative 50 (deepen inner harbor to 50')

8.1. Refined Benefits For Final Alternatives

After development of preliminary benefits for the initial harbor expansion alternatives based upon containerized cargo, the economic analysis methodology was refined and improved to provide more detailed predictions of port vessel traffic and resultant benefits. The major effort in this refinement was to capture benefits associated with non-containerized vessels, which included:

- Development of non-containerized (bulk and tanker) cargo forecast.
- Development of non-containerized vessel forecast.
- Identification of containerized and non-containerized transportation cost savings.

Other refinements of the economic analysis in response to comments by study participants included:

- Compared trade forecast volumes and growth rates to other commercial forecast for reasonableness
- Assessed sensitivity of project benefits to change in near term cargo forecast
- Compared available water depth (harbor and berth) of foreign ports which are trade partners with Savannah and other South Atlantic ports and assessed reasonableness and impact to fleet forecasts
- Evaluated containership operating practices, design and operating drafts, and channel depths at other major U.S. ports and compared to those experienced in Savannah

8.2. Refined Cost Estimates of Final Alternatives

During this phase of the feasibility study, the Engineering, Economic, and Real Estate appendices were refined and revised. The Draft Environmental Impact was concurrently refined to reflect additional data and coordination with appropriate resource agencies. Detailed information on each design and cost item is included in the Recommended Plan. Detailed Micro Computer Aided Cost Engineering System (MCACES and Cost Engineering Dredge Estimating Program (CEDEP) were prepared for each of the final alternatives.

The following is a summary of how the preliminary cost estimates for the initial harbor expansion alternatives were refined for the final alternatives.

8.2.1. Mobilization and Demobilization

Estimates of dredging equipment were refined. It was assumed five dredges would be used for Alternatives 45, 46, 47, and 48. However, due to environmental windows and the desire to complete construction in a timely manner, it was assumed eight dredges would be used for Alternative 50. Mobilization and demobilization costs included 25 percent contingencies.

8.2.2. Dredging non-Federal Berth

The final alternatives included dredging of one non-Federal berth (Garden City Terminal, Container Berth 7). These are project costs and will be 100 percent locally funded.

8.2.3. Dredging

Detailed CEDEP cost estimates were prepared for each of the final harbor expansion alternatives.

8.2.4. Debris Removal

The engineering analysis refined the estimated cost of debris, which remained equal for all final alternatives. The revised estimated cost was $2,278,000.

8.2.5. Disposal Area Improvements

The Dredged Material Management Plan was significantly revised to provide more accurate estimates of dredged material improvements for each alternative.

8.2.6. Navigation Aids

The estimated costs of navigation aids were slightly revised during the engineering analysis.

8.2.7. Engineering and Design

Individual items in the estimated costs for engineering and design were refined for the final alternatives. Some additional items were added for natural resources and cultural resources investigations during the engineering and design phase.

8.2.8. Supervision and Administration

Supervision and administration costs were revised to reflect more accurately the number of dredges used for dredging cost estimates for the final alternatives. Supervision and administration costs included 15 percent contingencies.

8.2.9. Lands and Damages

Construction of wideners and improvements to Kings Island Turning Basin will require the removal of land above the mean high water elevation. Estimates of real estate costs were computed and added to each of the final alternatives. Estimated real estate costs were $1,641,000. The preliminary costs for initial alternatives did not include real estate costs.

8.2.10. Environmental Mitigation

The Natural Resources Mitigation Plan was significantly revised to reflect additional information and coordination with resource agencies. A new Striped Bass Impact Avoidance Plan was added. The total environmental mitigation cost was estimated to be $10,013,000 and was identical for all final alternatives.

8.2.11. Old Fort Jackson Mitigation

The Cultural Resources Mitigation Plan for Old Fort Jackson was revised from a concrete filled mattress to sheet piling with concrete cap. Additional assessment of the preliminary engineering was conducted to evaluate the potential risk to the structure based on small errors in interpretation of the data. The resulting conclusion was that the cultural and monetary risks outweighed the cost savings resulting from not constructing a protective structure encompassing the entire Fort. Consequently, the cost of the entire wall system was incorporated. The revised cost of the mitigation plan was

increased from $548,000 to $1,273,000. The cost is identical for each of the final alternatives.

8.2.12. CSS Georgia Mitigation

The Cultural Resources Mitigation Plan for the CSS Georgia increased slightly due to more in-depth understanding of the mitigation requirements. The revised cost of $13,419,000 is identical for each of the final alternatives.

8.2.13. City of Savannah Water Intake

A potential for an increase in chloride levels at the City of Savannah water intake on Abercorn Creek exists due to implementation of a harbor expansion project. Abercorn Creek is a tributary of the Savannah River at River Mile 29, approximately 8 miles upstream of the upper limit of the authorized navigation project.

The City of Savannah indicated that if high chloride levels did occur at the intake because of implementation of a harbor expansion project, the most likely mitigation option would be to relocate the intake to the Savannah River. The City provided a preliminary estimate of $46,000,000. However, unless subsequent investigations determine there is a clear relationship between chloride levels and project depth, there would be no basis to implement any corrective measures. Alternatively, if a clear relationship does exist, other less costly or more appropriate corrective measures may be taken. Since it is possible that any harbor expansion alternative might have adverse impacts at the water intake, the cost of intake relocation was included for all alternatives.

8.2.14. Dissolved Oxygen

Dissolved oxygen levels in the Savannah River currently drop below the State of Georgia's standard, depending upon the state of the tide cycle and location of the measurement. A deeper channel would further effect the system's ability to assimilate oxygen. Feasibility level modeling concluded that this reduction in assimilative capacity could be as high as 1 PPM. Although the standard for dissolved oxygen level is under review by the Environmental Protection Agency and new standards are expected shortly, this effect had to be considered. Concern was expressed by the members of the River Committee of the Manufacturer's Council of the Savannah Chamber of Commerce regarding the potential effect on the future of their point source discharge permitting. With their assistance, costs were developed for a system to oxygenate the river to restore the assimilative capacity depression caused by a deeper channel. This cost, $24,000,000 was included in the costs for all final alternatives.

8.3. Other Economic Impacts

There is an additional requirement for any harbor expansion alternative that is not included in total project costs but is added to project costs during determination of the National Economic Development (NED) Plan.

8.3.1. Differential Maintenance Requirements

There would be an increase in operation and maintenance volumes and costs due to extension of the entrance channel from Station –60+000B to deep water for each of the increased channel depths. It is also possible, but not anticipated that changes in shoaling patterns in some inner harbor reaches could occur.

8.3.2. Dissolved Oxygen Maintenance Requirements

Installation of a system to oxygenate the river would involve annual operation and maintenance costs. These costs were included in the NED determination.

8.4. Total Project Costs

Detailed cost estimates are included in the Engineering Appendix. Table 13-1 summarizes the Total Project Costs of the final harbor expansion alternatives (See Attachment A).

8.4.1. Interest during Construction

In order to estimate present worth costs for project construction, the interest during construction must be computed. According to EP 1105-2-45, interest during construction (IDC) accounts for the cost of capital incurred during the construction period. Costs incurred during the construction period are increased by adding compound interest at the applicable project discount rate, 7-1/8 percent, from the date the expenditures are incurred to the beginning of the period of analysis, or base year. For this analysis, the IDC was determined based on mid-month convention with estimated construction time. IDC is used for the benefit cost analysis but it not included for cost sharing. The following formula is used for computation of the IDC.

$$IDC = \sum P_m [(1 + i)^{n-1} - 1]$$

where:

P_m = the mth monthly payment

n = number of periods, in months

i = monthly interest rate

8.4.2. Financial Analysis

Table 13-2 presents the project first cost and Interest during Construction (IDC) for the final alternatives based upon an economic life of 50 years and Federal interest rate of 7 1/8 percent. (See Attachment A.)

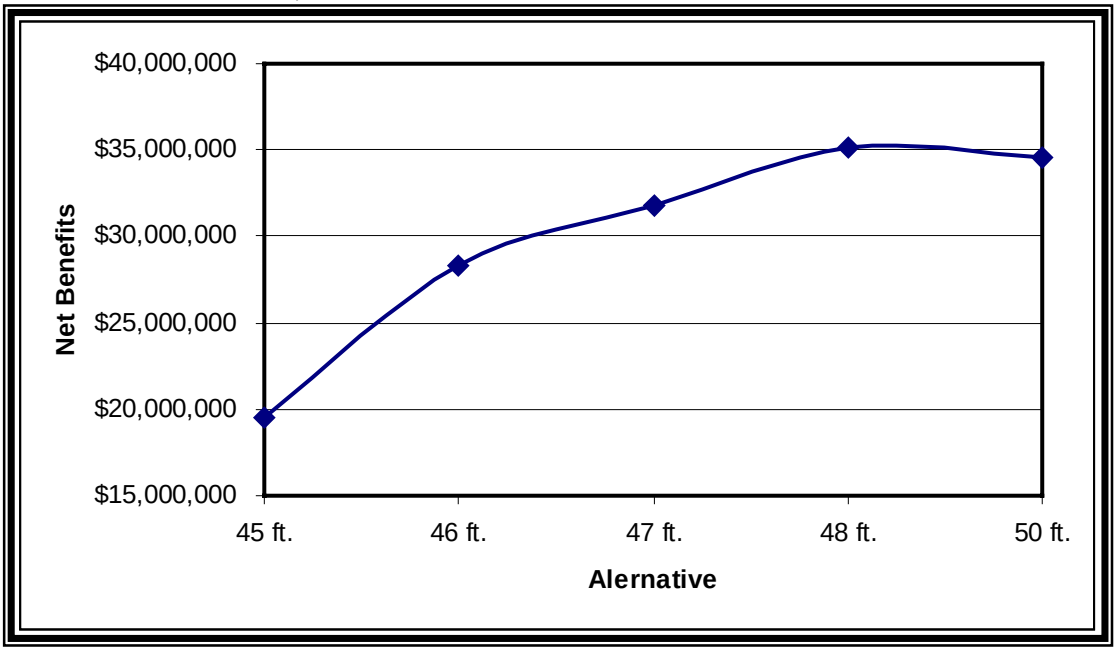
8.4.3. Benefit/Cost Analysis

Table 13-3 presents the benefit/cost analysis for the final harbor expansion alternatives based upon the refined benefit computations and the estimated project annual costs. The costs of differential maintenance and oxygenation system operation and maintenance are additional costs used for determination of the NED Plan. See Attachment A.

8.5. National Economic Development (NED) Plan

The alternative with the greatest net economic benefits (NED Plan) is required to be the plan recommended for Federal action (ER 1105-2-100, 5-16.b), unless there are overriding and compelling reasons favoring the selection of a plan larger or smaller than the NED Plan. Figure 6-1 graphically shows the cost, benefits, and net benefits for the final harbor expansion alternatives.

Figure 8-1 Final Alternatives, Selection of NED Plan



From the benefit/cost analysis, Alternative 48 has the highest net benefits and is therefore the NED Plan.

8.6. Comparison Of Final Alternatives

8.6.1. Evaluation Of Final Alternatives By Account

In addition to identification of the NED Plan, there are other categories, or accounts, which must be considered in selection of a recommended plan. The U.S. Army Corps of Engineers Principles and Guidelines (Engineering Regulation 1105-2-115) provides guidance for water and related land resources implementation studies. They stipulate four accounts by which alternative plans must be compared:

8.6.1.1 National Economic Development (NED)

How alternatives contribute to the National economy, such as dollar return in benefits for dollar cost of project.

8.6.1.2 Environmental Quality (EQ)

Non-monetary impacts on significant natural and cultural resources.

8.6.1.3 Regional Economic Development (RED)

Registers changes in the distribution of regional economic activity that result from each alternative.

8.6.1.4 Other Social Effects (OSE)

Alternative plan effects from perspectives that are relevant to the planning process and evaluation of alternatives but are not reflected in the other three accounts.

Figure 8-2 presents a comparison of the final harbor expansion alternatives by the four accounts.

Figure 8-2 Final Alternatives, Comparison by Accounts

	ALTERNATIVE				
	45′	46′	47′	48′	50′
NED Plan				NED Plan	
EQ	Least impact				Greatest impact
RED	Same	Same	Same	Same	Same
OSE	None identified	None identified	None identified	None identified	None identified

8.7. Locally Preferred Plan

The principal overriding reason for selecting a plan other than the NED Plan for implementation should be based on Federal, State, local, or international concerns. In some cases where the local sponsor prefers a plan more costly than the NED Plan, and the increased development is not sufficient to warrant full Federal participation, the sponsor will be required to pay the difference in cost between the Federally supportable plan and the Locally Preferred Plan (ER 1105-2-100, 5-16.d). The Locally Preferred Plan can be recommended for implementation by the U.S. Army Corps of Engineers.

The Georgia Ports Authority, local sponsor for the expansion project, considered the costs, benefits, projected future vessel traffic, environmental issues, planned growth in port facilities, and value added for additional depths beyond the NED Plan. It concluded that a 48-foot expansion project was most consistent with its goals and objectives.

8.8. Recommended Plan

After the NED Plan, Locally Preferred Plan (LPP), and the EQ, RED, and OSE Plans have been identified, all technical, economic, and environmental data must be considered and a tentatively selected plan chosen, after a comparative analysis of the adverse effects and benefits of all the alternatives are considered in detail.

This study of harbor deepening resulted in a Federal NED plan with a 48-foot channel, and the Locally Preferred Plan is for a 48-foot channel. Major objectives in the planning and implementation of Federal navigation projects include the following:

- Ensure the prudent expenditures of Federal cost sharing funding, which is evidenced through the NED plan.
- Minimize adverse environmental impacts, which, in some cases, requires that the EQ or No Action plan be the selected plan if the NED plan would result in unacceptable environmental impacts.
- Provide a navigation project that is acceptable to the local sponsor and is compatible with future requirements and conditions foreseen by the local sponsor.

Based on the data available, the Georgia Ports Authority chose the 48-foot harbor expansion alternative as the Recommended Plan. The No Action alternative was not chosen because this plan would not result in any benefits to the existing Savannah Harbor.

9. RECOMMENDED PLAN

9.1. Plan Components

The Recommended Plan includes the following:

- Deepening the inner harbor (Stations 0+000 to 103+000) to a project depth of –48 feet MLW.
- Deepening the entrance channel (Stations 0+000 to –14+000B) to a project depth of –48 feet MLW.
- Deepening the entrance channel (Stations –14+000B to –85+000B) to a project depth of –50 feet MLW.
- Constructing 10 wideners in the inner harbor and 2 wideners in the entrance channel.
- Enlarging Kings Island Turning Basin to 1,676 feet.

9.1.1. Channel Deepening

The Recommended Plan would provide for a 48-foot channel within the inner harbor and 48/50 feet in the entrance channel. Figure 9-1 shows the channel depths including advance maintenance. The entrance channel would be extended 25,000 feet from Stations –60+000B to –85+000B at naturally deep water.

Figure 9-1 Recommended Plan, Channel Depths

STATION	PROJECT DEPTH (-ft MLW)	ADVANCE MAINTENANCE (ft)	MAINTENANCE DREDGING DEPTH (-ft MLW)	ALLOWABLE OVERDEPTH (ft)
Inner Harbor				
103+000 to 102+000	48	0	48	2
102+000 to 100+000	48	2	50	2
100+000 to 79+000	48	2	50	2
79+000 to 70+000	48	2	50	2
70+000 to 50+000	48	4	52	2
50+000 to 41+000	48	4	52	2
41+000 to 24+000	48	4	52	2
24+000 to 0+000	48	2	50	2
Entrance Channel				
0+000 to –14+000B	48	2	50	2
-14+000B to –60+000B	50	0	50	2
-60+000B to –85+000B	50	0	50	2

Source: Engineering Appendix.

9.1.2. Dredged Material

9.1.2.1 Non-Federal Berth Dredging

The Recommended Plan includes dredging of one non-Federal berth (Garden City Terminal Container Berth 7). This is a project cost and will be 100 percent locally funded.

9.1.2.2 Differential Maintenance Dredging

The plan includes additional costs for extending the entrance channel from Station –60+000B to deep water at Station –85+000B plus a change in shoaling patterns for some inner harbor reaches. The cost of differential maintenance is not a project cost but is used in determining the National Economic Development (NED) Plan.

9.1.3. Hazardous, Toxic, and Radioactive Wastes

There would be a greater potential for encountering HTRW within the harbor bank sediments that may slough if the top channel were widened. However, all of the harbor expansion alternatives would retain the same top channel width by maintaining the current channel side slopes. Therefore, no HTRW studies were proposed for the Continuing Engineering and Design phase.

9.1.4. Future Operation and Maintenance Dredging

The deepened channel is not expected to result in any change in the total annual maintenance volumes for the harbor, with the exception of differential maintenance. Therefore, there are no future operation and maintenance costs assigned to the Recommended Plan.

9.1.5. Project Dredging

For programming purposes, it is assumed that all maintenance material, all new work material, and all allowable overdepth will be removed. For comparison purposes large class hopper dredges and 30 inch pipeline dredges were utilized as being most effective. Mobilization costs for two large class hoppers and two 30" pipeline dredges have been included. All plant mobilization distances were assumed to be 1000 miles.

Types and percentages of new work material range from silty sand to stiff rock/hard material. It is assumed that all maintenance, new work, and excess materials will be removed at the same time. All dredges are assumed to be large class vessels in order to meet time constraints although smaller equipment will be capable of performing the required work.

All computations have been based on the assumption that all materials from Station 0+000 to -85+000B will be removed by hopper dredges, although, environmental time constraints may necessitate the use of clamshell dredges, in conjunction with hopper dredges, for this portion of the work. Hydraulic pipeline dredges will remove all materials from Stations 103+000 to 0+0000.

The Recommended Plan would include dredging as follows:

- New work dredging in inner harbor (Stations 0+000 to 103+000) to deepen the channel to a project depth of -48 feet MLW
- New work dredging in the entrance channel (Stations 0+000 to –14+000B) to deepen the channel to a project depth of -48 feet MLW
- New work dredging in the entrance channel (Stations –14+000B to –85+000B) to deepen channel to a project depth of –50 feet MLW
- New work dredging to preserve existing advance maintenance
- Up to 2 feet of allowable overdepth

- Enlargement of Kings Island Turning Basin
- Ten wideners in the inner harbor
- Two wideners in the entrance channel

Figure 9-2 presents a summary of the dredging volumes for construction of the Recommended Plan. Dredging volumes include maintenance dredging plus 2-foot overdepth dredging.

Figure 9-2 Recommended Plan, Dredging Volumes

CATEGORY	DREDGING VOLUME (cy)
Annual Maintenance (excluding the sediment basin)	5,000,000
New Work (including Overdepth plus advance maintenance)	35,473,500
Total	40,473,500

Source: Engineering Appendix.

9.1.6. Disposal Area Improvements

The Dredged Material Management Plan in the Engineering has a detailed evaluation of existing disposal areas and improvements required with a harbor expansion project. Disposal areas 12A and 14B would be improved prior to the commencement of dredging, and disposal areas 12A, 12B, 13B, 14B, and Jones/Oysterbed Island would be improved after harbor expansion to replace total lost capacity in all the disposal areas.

After construction of the harbor expansion project, disposal area capacity will be needed for the average annual maintenance dredging. There will be a slight shifting of shoaling within the inner harbor, and additional maintenance dredging will be required in the extended portion of the entrance channel. The Engineering Appendix contains a discussion of the reasons for some of the shifts in location and amounts of shoaling.

There would be a project cost associated with early dike raising to accommodate the harbor expansion project. The project sponsor for providing and maintaining the disposal areas would be required to provide disposal area improvements several years sooner than the Without Project conditions. This leads to a project cost for the value of funds required to construct the earlier disposal area improvements. The cost analysis was based on Without Project and With Project disposal area improvements for the 20-year study life of the disposal areas. These costs are included in the disposal area improvements costs for the Recommended Plan.

9.1.7. Alternate Disposal Sites

As described in the Engineering Appendix, three alternate water disposal sites were considered for placement of dredged material from the entrance channel that is normally placed in the approved ocean disposal site:

- Nearshore site off north end of Tybee Island.
- Submerged berms south of entrance channel.
- Nearshore feeder berm parallel to Tybee Island beach.

In addition, local officials at Tybee Island are interested in placement of new work dredged material to benefit the beach at Tybee Island, assuming the material will be close to beach-quality sand. At this time, with the geotechnical information available, it does not appear there will be sufficient quantity of new work dredged material to result in a more cost efficient use for alternative sites. Additional sampling and testing will be conducted during the engineering and design phase, and if this data indicates the quantity of dredged material is suitable based on the quality criteria identified in the Final Tier I EIS, these alternate disposal sites will be given further consideration. These additional borings will be done to support the dredging plans and specifications and are not being taken for evaluation of the alternate disposal sites. Costs are included in Code 30 Continuing Engineering and Design to prepare environmental clearances, if required, for nearshore disposal.

9.1.8. Debris Removal

The dredging contractors will encounter debris on the riverbanks, on the existing river bottom, and in the new work prism. The dredging contractors will be required to remove and dispose any debris encountered. A separate contract for debris removal will not be awarded.

9.1.9. Construction Phasing

9.1.9.1 Dredging

Construction of the Recommended Plan will include three dredging contracts:

1) Entrance channel dredging
2) Lower harbor dredging
3) Upper harbor dredging

Closure of Middle River for the Striped Bass Impact Avoidance Plan would be accomplished under the upper harbor dredging contract. It is anticipated that dredging the entrance channel will be performed using clamshell or mechanical dredges and hopper dredges. Hopper dredges will be limited to working between December and March because of environmental restrictions, while clamshell and mechanical dredges do not have these environmental restrictions.

9.1.9.2 Dike Raising

It is anticipated that construction of the dike improvements required to accommodate disposal of dredged material from the expansion dredging will commence in October 1999. A complete description of the disposal area improvements is included in the Dredged Material Management Plan in the Engineering Appendix.

9.2. Cultural Resources

Cultural resources requirements for the Recommended Plan include providing protection to Old Fort Jackson and excavation and documentation of the CSS Georgia. Additional cultural resources studies are proposed during the Continuing Engineering and Design phase. As provided in ER 1105-2-100, cultural resources mitigation costs are non-reimbursable Federal costs up to the one- percent limitation specified in Section (7)(a) of Public Law 93-291. When the costs for mitigation and data recovery exceed the one- percent limitation, a waiver to spend more than one percent on mitigation and data recovery must be forwarded to HQ USACE for approval. Once a waiver is obtained, costs that exceed the one- percent limitation will be apportioned on the same basis as other joint and separable costs. Mitigation and data recovery costs, regardless of whether they are Federal or non-Federal or whether they are within or over the one percent limitation, are to be kept separate from other project construction costs because they are excluded from economic analyses and are not to be allocated to project purposes.

9.2.1. Cultural Resources Investigations during CED

Additional cultural resources field studies, including dives, surveys, and tests are required of new work areas for locating any additional cultural resources. These additional studies are included in the Code 30 Continuing Engineering and Design (CED) costs. Additional field studies are also required prior to excavation and recovery of the CSS Georgia. These are also included in the total CED costs. Total estimated costs of the cultural resources investigations are $800,000 plus $314,000 for engineering support.

9.2.2. Cultural Resources Mitigation Plans

9.2.2.1 Old Fort Jackson

The selected option for protecting the moat wall at Old Fort Jackson is construction of a steel sheet pile wall. Steel sheet piling has an extensive history of success in Savannah Harbor for providing bank stability and slope protection. A portion of the moat wall around the tunnel structure is presently protected by steel sheet piling. Placement of new sheet piling will result in lower impacts to the fort and adjacent property since excavations are not required to place or anchor the wall. The wall will be below the water surface and not visible to visitors to the fort. The sheet pile wall has a longer service life than other options considered and will require minimal maintenance.

9.2.2.2 CSS Georgia

The cultural resources mitigation plan for the CSS Georgia includes excavation and recovery and is estimated to cost $13,419,000. For cost sharing purposes, these costs are the *Historic Preservation Mitigation and Data Recovery (HPMDR)* costs.

9.3. Natural Resources

9.3.1. Environmental Impacts

The environmental impacts of the Recommended Plan are shown in Figure 9-3.

Figure 9-3 Recommended Plan, Environmental and Cultural Resources Impacts

	IMPACT
Water Quality	Extent of salinity penetration increased in Front River, decreased in Middle and Back Rivers
	Dissolved oxygen assimilative capacity decreased
	Substantial increase in turbidity for a period of time at dredging area and disposal sites
	Total dredged material = 32,270,000 cy
Acres of Wetlands Impacted	10 by removal <1,000 by salinity penetration
Fisheries	Potential for reduction in habitat due to dissolved oxygen capacity changes and salinity penetration
Benthics	Unavoidable loss
Endangered Species	Special conditions to avoid or minimize impacts
	Periodic lower dissolved oxygen at currently believed short nosed sturgeon nursery area. (Short-nosed sturgeon life cycle in the Savannah River is not definitively understood)
Wildlife	Loss and/or alteration of habitats at confined disposal site, nearshore berms, and open water site
Cultural Resources	Removal of CSS Georgia wreckage with appropriate data recovery and curation
	Old Fort Jackson instability increased
Shoreline Erosion	None

Source: Environmental Impact Statement.

9.3.2. Environmental Studies during CED

The Recommended Plan includes additional environmental studies during Continuing Engineering and Design (CED).

9.3.3. Natural Resources Mitigation Plan

The Environmental Impact Statement assesses the potential impacts on endangered species, fisheries, benthic communities, birds, marine mammals, water quality, historic properties, and wetlands resulting from the various alternatives.

Three areas of potentially significant impact were identified:

- Conversion of freshwater wetlands to saltwater wetlands.
- Loss of saltwater wetlands.
- Increased salinity penetration and decreased dissolved oxygen levels affects on fisheries.

A Natural Resources Mitigation Plan sufficient to capture the maximum actions required by implementation of the recommended plan was developed. This plan is intended to suffice for the feasibility authorization decision and addresses potential maximum losses to environmental resources. The cost of this mitigation plan is included in total costs for the Recommended Plan. The Natural Resources Mitigation Plan includes:

- Purchasing 3,000 acres of freshwater wetlands.
- Creating 80.5 acres of new saltwater wetlands.
- Deepening Port Wentworth Turning Basin prior to project construction, and conduct of a multi-year study of sturgeon behavior in the estuary.

Figure 9-4 shows the current estimated cost of the plan. Code (06) items only include the cost to construct the feature and do not include real estate, CED, or S&A, which are included in total project costs.

Figure 9-4 Recommended Plan, Cost of Natural Resources Mitigation Plan

ISSUE	MITIGATION	COST
Freshwater Wetlands	Purchase 3,000 acres freshwater wetlands	$701,000
Saltwater Wetlands	Create 80.5 acres saltwater wetlands	$1,400,000
Shortnose Sturgeon	Dredge Port Wentworth Turning Basin	$617,000
	Conduct multi-year behavior study	$300,000
Total		$3,018,000

Source: Environmental Impact Statement, Engineering Appendix.

9.3.4. Striped Bass Impact Avoidance Plan

The proposed impact avoidance plan for striped bass would include the following:

- Closure of mouth of Middle River at confluence with Savannah/Front River.
- Closure of two channels from Steamboat Cut to Middle River.
- Open new channel near New Cut from Middle River to Back River.

This action would eliminate the movement of high salinity river tidal flows into the mouth of Middle River and into Back River. Closure of the mouth of Middle River and two channels from Steamboat Cut to Middle River would eliminate movement of high salinity river tidal flows through these channels into Middle River. A new cut near the closed New Cut would be constructed from the closed Middle River to Back River, restoring movement of fresh water into Back River.

9.3.5. Environmental Dredging Restrictions

A number of environmental restrictions apply to construction dredging operations. Hopper dredging activities shall be limited to operating between 01 December and 15 April of each year. No deviations will be allowed for operations outside of this time period. Normal vessel speeds may be used for the duration of this contract during daylight hours (sunrise to sunset). However, the contractor shall restrict dredge and attendant vessel speeds to less than 5 knots or less during night (sunset to sunrise) operations unless information from the Right Whale Early Warning System or any other observation/information reveal there are no Right whales within 15 nautical miles of the project area. If no Right whales are sighted during the day's surveillance, the vessel speeds will not be restricted.

The contractor shall provide, on-board the dredge and all vessels used to transport personnel and equipment between landings and the worksite(s), one trained endangered species observer during daytime operations to watch for endangered

species during the period 01 December through 31 March. There are also dredging restrictions upstream of Fields Cut (River Mile 5) between 15 March and 01 June to avoid impacting the striped bass spawning season. In addition to the endangered species observers, the contractor shall provide two turtle observers between 01 April and 15 April. The turtle observers shall be on-board the hopper dredge/dredges 100 percent of the time the contractor will be dredging and transiting to and from the disposal site.

The trained observers shall document any turtle or turtle-parts retained in the screens. The cost estimates have taken into account all environmental considerations concerning Right whales and sea turtles.

9.3.6. Finalization of Environmental Actions

9.3.6.1 Tier II Environmental Impact Statement

Determination of the specific environmental impacts and resulting mitigation plan will be conducted during CED. The complex environment and competing interests require detailed scientific analysis of the various environmental concerns and iterative evaluation of the effects of channel design and avoidance options. This effort, which will result in the preparation and approval of a Tier II EIS detailing the specific mitigation for the project in full compliance with NEPA requirements. A satisfactory Record of Decision is required prior to the commencement of construction of any project. See the Final Tier I Environmental Impact Statement for details and Attachment B for details.

9.4. Real Estate Requirements

Real estate requirements for the Recommended Plan include enlargement of Kings Island Turning Basin and wideners, land acquisition for the Natural Resources Mitigation Plan, and construction easements for the Striped Bass Impact Avoidance Plan. Figure 9-5 shows the total real estate requirements including 25 percent contingencies.

Figure 9-5 Recommended Plan, Real Estate Requirements

ITEM	COST
Channel Improvement/Sloughing Easement (18.38 acres)	$587,000
Improvement	0
Fee Acquisition (Mitigation Lands 3,080.5 acres)	$920,000
Mineral Rights	0
Damages	0
Relocations	0
P.L. 91-646 Relocation Costs	0
Acquisition Costs – Admin. (10 parcels/owners)	$134,000
Federal	$25,000
Non Federal	$109,000
TOTAL ESTIMATED REAL ESTATE COSTS	**$1,641,000**

Source: Real Estate Appendix.

Figure 9-6 presents a summary of real estate costs by code of accounts.

Figure 9-6 Recommended Plan, Real Estate Costs by Code of Accounts

ITEM	COST
(01) Acquisition	$1,507,000
(01) Administration	134,000
Total	$1,641,000

Source: Real Estate Appendix.

9.5. Navigation Aids

Additional navigational aids will be required for the extension of the entrance channel and the sea buoy will be relocated to mark the seaward end of the channel. Increasing the width in the Kings Island Turning Basin will require the repositioning of beacons 12 and 14. It is not anticipated that additional beacons or buoys will be required in the inner harbor, however, the results of the ship simulator may recommend additional navigation aids to assist the pilots in transit or docking maneuvers.

9.6. Other Economic Impacts

9.6.1. Differential Maintenance

Each of the final harbor expansion alternatives results in an extension of the entrance channel to deep water as a result of the increased depth in the channel. This increase in entrance channel length would result in an increase in maintenance dredging. The cost of this differential maintenance is not a project cost but is used in determination of the National Economic Development (NED) Plan.

9.6.2. City of Savannah Water Intake

Potential increases in chloride levels in the City of Savannah Water Supply intake were identified. The water intake for the Plant is located on Abercorn Creek, a tributary of the Savannah River immediately upstream from the I-95 Bridge (RM 29). The City of Savannah provides water to various industries in the region. Under their present contract, they are required to provide water with chloride concentrations less than 12 mg/L.

Analysis of historic daily measurements identified that, at present, there are times when their chloride concentrations exceed 12 mg/L. If deepening of the channel creates increases in the present chloride levels at the intake, the period of time when the City of Savannah is in violation of their contract with local industries will increase.

Impacts of the last deepening upon the salinity levels at the Georgia Highway 25 Bridge along the Front River were quantified. The analyses identified that salinity intrusion within the Front River was increased due to the 4.0-foot deepening which occurred in 1994. A concern is raised about a relative increase in chlorides that

occurred after the previous deepening projects. Analysis of the City of Savannah data did not indicate a clear correlation of chloride levels at the intake to salinity increases caused by the last deepening. Portions of Abercorn were dredged between December 1992 and March 1993, which would have affected hydraulic conditions and may have affected chloride levels at the intake. Because of the variable nature of the system, and the many factors that influence chlorides, the results of these analyses were not able to isolate an impact to the City's raw water source.

During the public coordination sessions for this study, the City of Savannah's Water Department noted that concentrations of chlorides at the City's water intake increased at the same time as the previous dredging project to deepen the channel from 38 feet to 42 feet. The Water Department is concerned that further deepening will increase chloride levels even further. Prior to the last deepening, the chloride levels measured at the intake generally averaged 8.5 mg/L. The chloride levels increased to a maximum of 15 mg/L when river flows were low and decreased to about 3 mg/L when river flows were higher. Subsequent to the last deepening, chloride concentration readings ranged from highs of 20 mg/L to low of 6 mg/L. These readings are well below the EPA's Safe Drinking Water Act standards of 250 mg/L. However, the City reports that water supplied to industrial process users with concentrations above 12 mg/L would increase the operational and maintenance costs for some of the major water users in the area.

Other than the timing, there are no data to establish a cause and effect relationship between the previous deepening and the chloride increases. The City has measurements only at the intake and has no measurements either upstream or downstream. Thus, it is not possible to determine the source of the chlorides, whether chloride levels are changing elsewhere in the river, the effect of further deepening on chloride levels, or what alternatives may be available to deal with changes in chloride levels even if a cause and effect relationship is determined.

The Georgia Ports Authority, in coordination with the City, has proposed a plan of study to determine: (1) whether there is a cause and effect relationship between channel deepening and chloride levels; if so, (2) what the actual impacts to industry might be; and, if there are impacts, (3) what might be done to ease those impacts.

If an increase in chloride concentrations is identified as having an adverse effect on industrial water users, the effect may be addressed by one of the following options being considered at this time: (1) relocation of the water intake to a location of more favorable chloride concentrations; or (2) implementation of a plan developed in a recent USACE study to restore river flows to a portion of the Savannah River estuary. While the study was done as an environmental restoration project, the water management techniques involved would increase flows at the location of the water intake and, presumably, reduce chloride concentrations in the City's raw water.

For plan formulation purposes only, the higher cost option of moving the intake to the Savannah River was selected.

9.7. Cost Of Recommended Plan

9.7.1. Detailed Cost Estimate

A detailed MCACES AND CEDEP cost estimate was prepared for the Recommended Plan, using assumptions and input previously described. The total detailed cost estimate is included in the Engineering Appendix

9.7.2. Construction Costs

The Recommended Plan includes four major construction items:

- Dredge mobilization
- Dredging
- Debris removal
- Dredged material management plan

The current schedule for the Recommended Plan includes five contracts:

- Offshore bar dredging
- Lower harbor dredging
- Upper harbor dredging
- Disposal area dike raising
- Protection of Old Fort Jackson

Although closure of the Middle River for the Striped Bass Impact Avoidance Plan would be accomplished under the upper harbor dredging contract, an additional contract is required for opening a new channel from Middle River to Back River.

9.7.3. (30) Continuing Engineering and Design Costs

A typical Corps of Engineers cost estimate includes costs for Code 30 Preconstruction Engineering and Design (PED) leading to the award of one contract. However, a harbor expansion project would include multiple contracts and design during construction. Therefore, for the report these costs are captured as Code 30 Continuing Engineering and Design (CED) to recognize the multiple contracts and continuing engineering and design effort.

Additional detailed engineering analyses will be performed during the CED phase, including detailed project designs, refined cost estimates, and construction plans and specifications. Code 30 CED costs for the Recommended Plan are shown in Figure 9-7.

Major CED activities will include:

- Conducting a ship simulator study by Waterways Experiment Station to verify the proposed wideners and channel alignment.
- Obtaining additional investigations of subsurface material prior to completing an assessment of materials to be dredged within the project area for plans and specifications and for final design of dike improvements. Determine any presence of rock in the proposed channel deepening.
- Using information from the additional channel borings to evaluate suitability of placing material in nearshore disposal site or Tybee Island.
- Conducting magnetometer and side scan sonar surveys.
- Conducting hydrographic and topographic surveys.
- Conducting sedimentation modeling to determine if the harbor expansion project requires modification of the existing advance maintenance locations and depths.
- Preparing detailed designs for the proposed Natural Resources Mitigation Plan.
- Conducting additional cultural resources investigations.
- Conducting additional environmental studies.
- Preparing plans & specifications for:

  Three dredging contracts

  Disposal area improvements

  Protection for Old Fort Jackson

Figure 9-7 Recommended Plan, Code 30 Costs, Continuing Engineering and Design

ITEM	COST
Section 204 Agreement	$40,000
Environmental Studies	200,000
Shortnose Sturgeon Study	300,000
Cultural Resources Investigations	800,000
Environmental Clearances for Nearshore Disposal	100,000
Engineering Support for Cultural Resources Investigations	314,000
Value Engineering	50,000
Ship Simulator Study	238,000
Geotechnical Investigations (support to dredging P&S)	506,000
Sedimentation Model	200,000
Support for Sedimentation Model	22,000
Weir Water Quality Monitoring	160,000
Plans & Specifications/Cost Estimates: Disposal Area Dike Improvements Old Fort Jackson Dredging Contracts (3)	 238,000 89,000 1,040,000
Engineering & Design Surveys Before & After Construction	500,000
Engineering Management	250,000
Contract Award Documents (5)	50,000
BCO Review & Bid Evaluation	5,000
Environmental Oversight during Design/Construction	100,000
Programs & Project Management	144,000
GPA Support during Continuing Engineering & Design	300,000
Subtotal	$5,446,000
15 % contingencies	817,000
Total Code 30	$6,263,000

Source: Engineering Appendix, Environmental Impact Statement.

9.7.4. (31) Supervision and Administration Costs

Code 31 Supervision and Administration (S&A) costs for the Recommended Plan are summarized in Figure 9-8. S&A costs include all construction management activities for the six contracts from pre-award requirements through final contract closeout.

Figure 9-8 Recommended Plan, Code 31 Costs, Supervision and Administration

ITEM	COST
S&A Documents	$7,200,000
Programs & Project Management	300,000
Subtotal	$7,500,000
15 % contingencies	1,125,000
Total Code 31	$8,625,000

Source: Engineering Appendix.

9.7.5. Total Project Costs

An MCACES AND CEDEP cost estimate was prepared for the Recommended Plan. Figure 9-9 is the Project Cost Summary for the Recommended Plan. Based upon data from the Project Cost Summary, Figure 9-10 presents the estimated first cost for the Recommended Plan. Code (06) items are the construction costs only to build the permanent features, and do not include Real Estate, CED, or S&A costs.

Figure 9-9 Recommended Plan, Project Cost Summary

PROJECT COST SUMMARY	.
Annual Project Cost	$16,783,200
Annual Costs for NED Determination:	
Annual O&M Differential Maintenance	$149,000
Annual DO System Maintenance	$650,000
Adjusted Annual Project Cost	$17,582,200
Annual Benefits	$52,742,579
Benefit/Cost Ratio	**3.00**
Net Benefits	**$35,160,379**

Source: Engineering Appendix, Economic Appendix.

Figure **9-10 Recommended Plan, Total Project Costs**

ITEM	48 ft.
General Navigation Features (GNF)	
(12) Dredging	$96,722,100
(12) Mobilization	$3,367,100
(12) Debris Removal	$2,278,805
(12) Disposal Area Improvements	$11,863,800
(30) Continuing Engineering & Design	$8,400,000
(31) Supervision & Administration	$3,844,000
Subtotal GNF	**$126,475,805**
Lands, Easements, Relocations & Rights of Way (LERR)	
(01) Acquisition	$2,051,300
(01) Administration	$134,000
Subtotal	**$2,185,300**
(12) Aids to Navigation	$810,875
(12) Dredge Non-Federal Berth	$454,000
(06) Environmental Mitigation	$9,612,480
(06) Chloride Mitigation (if reqd)	$46,000,000
(06) Dissolved Oxygen Mitigation	$24,000,000
Subtotal	$80,877,355
Subtotal (Federal Appropriation)	**$209,538,460**
Historic Preservation Mitigation & Data Recovery (HPMDR)	
(18) Old Fort Jackson	$1,264,800
(18) CSS Georgia	$13,083,525
Subtotal HPMDR	**$14,348,325**
Total	**$223,886,785**

Note: Costs are rounded to nearest $1,000.
Total costs do not include Interest During Construction and are not escalated to reflect inflation.
HPMDR costs are not included in the benefit/cost analysis.
Source: Engineering Appendix

9.8. Economic Analysis

9.8.1. Financial Analysis

Figure 9-11 presents the project first cost and Interest During Construction (IDC) for the Recommended Plan based upon an economic life of 50 years and Federal interest rate of 7 1/8 percent. Construction is estimated to commence in October 2001 and last 30 months.

Figure 9-11 Recommended Plan, Economic Cost

	Cost
Construction:	
Start	Oct-01
Duration	30 months
Total Project Costs*	$209,538,460
Interest During Construction	$18,472,156
Total Economic Cost including IDC	$228,010,616
Annual Project Cost	**$16,783,200**

Source: Economic Appendix.

9.8.2. Benefit/Cost Analysis

The refined benefit analysis shows the Recommended Plan would produce an estimated $52,742,579 in annual navigation benefits. Figure 9-12 presents the benefit/cost analysis for the Recommended Plan.

Figure 9-12 Recommended Plan, Benefit/Cost Analysis

ANNUAL BENEFITS AND COSTS	48 ft.
Annual Project Cost*	$16,783,200
Annual Costs for NED Determination:	
Annual O&M Differential Maintenance	$149,000
Annual DO System Maintenance	$650,000
Adjusted Annual Project Cost	$17,582,200
Annual Benefits	$52,742,579
Benefit/Cost Ratio	**3.00**
Net Benefits	**$35,160,379**

Source: Economic Appendix.

9.9. Plan Accomplishments

The Recommended Plan will address the known problems and deficiencies within Savannah Harbor and allow the harbor to efficiently and safely accommodate existing and projected vessel traffic.

The increased channel depth will allow for improved efficiency for ships maneuvering the harbor by eliminating the need for light loading or waiting for favorable tides. Maneuvering concerns at various reaches of the harbor will be addressed by providing wideners. Enlarging and deepening the Kings Island Turning Basin will alleviate maneuvering difficulties and allow the basin to accommodate future vessels.

Dike raising in selected upland disposal sites will allow the sites to accommodate dredged material from project implementation and future dredged material from the inner harbor

9.10. Summary

9.10.1. Economics

Savannah Harbor vessel traffic is currently experiencing operational difficulties due to channel depths and widths, thereby adding costs to the transportation of commodities into and out of the port. Without an expansion problem, these problems will become critical with the arrival of larger vessels from the world fleet. The NED Plan is for a 48-foot harbor-deepening project, and the Locally Preferred Plan is for a 48-foot project. Therefore, the Recommended Plan is for a 48-foot navigation project.

The net benefits and accompanying benefit/cost ratio result in a strong justification for the feasibility of the Recommended Plan.

9.10.2. Cultural Resources

The Recommended Plan would have adverse impacts to Old Fort Jackson and the CSS Georgia. A cultural resources mitigation plan was developed which would provide for protection of Old Fort Jackson and removal of the CSS Georgia wreckage from the river bed with appropriate data recovery.

9.10.3. Environmental Impacts

The Environmental Impact Statement concluded the Recommended Plan might result in environmental impacts in three areas:

- Potential conversion of <1,000 acres of freshwater wetlands into saltwater wetlands.
- Potential loss of 10 acres of saltwater wetlands.
- Potential decreases in dissolved oxygen assimilative capacity and increase in salinity penetration of the Front River.

A Natural Resources Mitigation Plan was developed to address these potential impacts. In addition, the Final Tier I EIS identifies a possible increase in salinity levels in Middle River and Back River striped bass spawning areas. A Striped Bass Impact Avoidance Plan was developed to address this issue. A detailed Supplemental Environmental Impact Statement will be developed and approved providing for the specific mitigation actions for the project.

10. IMPLEMENTATION

A detailed project schedule for implementation of the Recommended Plan will be included in the Project Management Plan (PMP). Figure 10-1 is a summary of the important milestones, subject to change, leading to initiation of project construction in 2001.

Figure 10-1 Recommended Plan, Project Implementation Schedule

ACTION	ESTIMATED DATE
Submit FR & Final Tier I EIS to ASA(CW)	01 Aug 98
File Draft Final Tier I EIS with USEPA	10 Aug 98
Submit Draft FR & Draft Final Tier I EIS to other agencies and public	10 Aug 98
Notice of Availability	10 Aug 98
Federal/state/local/public 45-day review	10 Aug 98
Project Authorization in WRDA 1998	31 Oct 98
Section 204 Agreement	31 Jan 01
Construction contract awarded	01 Aug 01
Initiate construction (contract #1 dike construction)	01 Sep 01
Complete project construction	Sep 2005

10.1. Aids to Navigation

Aids to navigation include buoys, lights, ranges, markers, and other devices and systems that are required for safe navigation and to achieve project benefits. They are not categorized as general navigation features because the determination of the aids needed and their installation and maintenance, when they are a Federal responsibility, is by the U.S. Coast Guard. Aids to navigation provided by the Coast Guard are a Federal cost of Corps of Engineers projects but are not subject to project cost sharing. In the absence of sufficient Coast Guard funding or justification, non-Federal interests may be required to provide the navigation aids.

10.2. Federal and Non-Federal Costs

Project cost sharing for deep draft navigation projects is determined by the percentages shown in Figure 10-2.

Figure 10-2 Project General Navigation Features, Cost Sharing Percentages by Depths

DEPTH	FEDERAL SHARE	NON-FEDERAL SHARE
20' to 45'	75 %	25 %
>45'	50 %	50 %

In addition to the cost sharing apportionment for the cost of General Navigation Features (GNF), additional costs or funding requirements includes:

- Disposal area improvements are cost shared same as GNF.
- Aids to navigation are 100 % Federal cost.
- Lands, easements, rights of way, and relocation (LERRs) costs are 100 % non-Federal.
- LERRs administrative costs are cost shared same as GNF.
- Historic Preservation Mitigation & Data Recovery (HPMDR) costs:

  One percent of Federal appropriations (GNF + Aids to nav) = 100 % Federal.

  Remaining HPDMR costs cost shared same as GNF.
- Additional funding requirements:

  10 % of GNF credit to Federal and cost to non-Federal.

  10 % of HPDMR above one % credit to Federal and cost to non-Federal.

  Credit to non-Federal cost equal to LERRs cost.

Actual costs incurred by the Georgia Ports Authority for conducting the feasibility study were not included in detailed cost estimates contained in this report. These costs will be subject to recovery of the Federal cost share upon appropriation of Federal funds.

Differential maintenance costs will be shared annually for the life of the project by the Federal and non-Federal sponsor.

All costs not a part of General Navigation Features, including natural resources and cultural resources investigations and mitigation, were assigned to the first deepening level, which is the 45-foot plan.

The following tables illustrate the sequential development of cost sharing based upon depths, cost sharing percentages for depths, and differential costs between depths. Project cost estimates by line item are shown in the format required to compute cost sharing. See Attachment A.

Table 13-1 summarizes total project costs for the final alternatives.

Table 13-2 summarizes economic costs for the final alternatives

Table 13-3 summarizes benefit/cost ratios for the final alternatives.

Table 13-4 shows the total first cost for a 45 and 48 ft. project.

Table 13-5 summarizes cost apportionment for the 45' project based upon 75/25 % percentages.

Table 13-6 summarizes the differential costs from a 45' to 48' project and cost sharing based upon 50/50 % percentages.

10.3. Section 204 Construction and Reimbursement

The Georgia Ports Authority will construct the recommended harbor expansion project and, subject to Federal appropriations, will be reimbursed for the Federal share of the project. The following are pertinent excerpts from Section 204 of the Water Resources Development Act of 1986.

SEC.204 CONSTRUCTION OF PROJECTS BY NON-FEDERAL INTERESTS

(d) AUTHORITY TO CARRY OUT IMPROVEMENT. – Any non-Federal interest which has requested and received from the Secretary (of the Army) pursuant to subsection (b) or (c) of this section, the completed study and engineering for an improvement to a harbor or an inland harbor, or separable element thereof, for the purpose of constructing such improvement and for which improvement a final environmental impact statement has been filed, shall be authorized to carry out the terms of the plan for such improvement…….

(e) REIMBURSEMENT. –

(1) GENERAL RULE. – Subject to the enactment of appropriation Acts, the Secretary is authorized to reimburse any non-Federal interest an amount equal to the estimate of Federal share without interest, of the cost of any authorized or inland harbor improvement……

Additional information on implementation of a Section 204 project is included in the legislation.

Upon authorization of the recommended harbor expansion project and subsequent appropriation of Federal funding, the U.S. Army Corps of Engineers and the Georgia Ports Authority would enter into an agreement stipulating local sponsor items of local cooperation pursuant to Section 204 of the Water Resources Development Act of 1986.

10.4. Financial Capability of Non-Federal Sponsor

The Georgia Ports Authority intends to fund its share of project construction with moneys provided by the State of Georgia. These funds will be provided in the state budget and financed by state General Obligation Bonds. The financing mechanism for project construction by the Georgia Ports Authority will be to enter a budget request of the Governor of the State of Georgia for the State to authorize issuance of 20-year bonds specifically for the deepening of the Savannah Harbor. The amount of the bonds should be more than adequate to meet the anticipated total project costs.

The State of Georgia has an excellent credit rating, as evidenced by a Moody's AAA and Standard & Poor's AAA rating on its recent GO Bond issues. Based upon prior performance, high bond ratings, and the forecasted growth for the port, the financial risk of entering into this project is minimal.

11. PUBLIC PARTICIPATION, COORDINATION, AND COMMENTS

11.1. Public Involvement

11.1.1. Introduction

The public involvement program for the Savannah Harbor Expansion Feasibility Study was developed and executed jointly by Georgia Ports Authority (GPA) personnel, members of GPA's contract team, and Savannah District, U.S. Army Corps of Engineers employees. GPA established an aggressive schedule for completing the feasibility study in one year versus the usual three to four years. This necessitated an intense, fast paced public information campaign to inform and involve those with interests in the study. This was of particular importance in interacting with Federal and state agencies that have a vital role in feasibility studies.

11.1.2. Purpose and Requirements

The Administrative Procedures Act and the National Environmental Policy Act (PL 91-190) (NEPA) are the principal legislative acts requiring public involvement. There are many other sources of guidance and direction on this topic but these two acts provide the over arching philosophy and spirit of public involvement. The feasibility study was performed in full accordance with this guidance.

11.1.3. Strategy

The study was conducted in an open atmosphere with a goal of attaining understanding and cooperation from affected and interested entities. There was a particular focus on collaboration with state and Federal agencies. At the initiation of the study, a public information strategy was developed which included ongoing meetings and contacts with involved groups.

11.1.4. Implementation

Soliciting and incorporating public input were an integral part of the process undertaken for this project. Very early in the study, forums were held for briefing and discussion of the proposed deepening alternatives. An initial meeting was held for groups and individuals who in the past had expressed interest in Savannah harbor activities. Project representatives from the Georgia Ports Authority, Savannah District, Lockwood Greene and Applied Technology Management were present.

11.1.5. Scoping Meetings

The Council on Environmental Quality regulations (40 CFR 1051.7) require that a process called "scoping" be used to identify significant issues. The goal of scoping is to identify issues that need to be included in the study and particularly the Final Tier I EIS. Scoping for the study was accomplished by using both focused small group meetings and two broadly announced public sessions.

11.1.6. Interest Groups

Based on information developed in the conduct of the reconnaissance study, the Long Term Management Strategy development, and ongoing contacts with harbor interests, three primary sets of interests were identified: salinity, impacts to natural resources and cultural resources. Advisory groups were formed to focus on each of these sets of issues. Each of these areas was vitally important to the technical project evaluation.

11.1.6.1 Technical Advisory Group (TAG)

The first group to be established was the TAG. The purpose of the TAG was to provide ongoing involvement in modeling study efforts for technical personnel from important agencies. The TAG focused on the water quality modeling done to assess salinity or other water quality changes that might occur due to the project. The results of the model analysis provided the base for impact assessment and mitigation strategies. Due to the importance of the modeling to the study efforts and the complexity of the technical work involved, the TAG served as an ongoing source of review, advice and information. All participants were kept abreast of the assumptions, techniques and results of the modeling as they were developed. The TAG was composed of the following member agencies:

- Georgia Cooperative, Fish & Wildlife Unit, University of Georgia
- U.S. Fish and Wildlife Service
- U.S. Geological Service
- South Carolina Office of Coastal and Resource Management
- Georgia Department of Natural Resources
- South Carolina Department of Natural Resources
- National Marine Fisheries Service
- U.S. Environmental Protection Agency
- South Carolina Department of Health and Environmental Compliance
- City of Savannah
- Savannah Harbor Expansion Study Team:
- Georgia Ports Authority
- Applied Technology and Management
- U.S. Army Corps of Engineers
- Lockwood Greene

11.1.6.2 Natural Resources Advisory Group (NRAG)

The NRAG was assembled to provide emphasis and expert assistance in determining species of concern, species critical conditions, impacts of water quality changes on resources of importance and mitigation alternatives. NRAG members provided data sources, unpublished data, advice and assistance. Their role was particularly important in relation to striped bass, sturgeon, and setting standards for critical habitat conditions. Most of the members of the Technical Advisory Group were also on the NRAG.

11.1.6.3 Cultural Resources

Old Fort Jackson is owned by the State of Georgia and operated by the Coastal Heritage Society (CHS). The CHS has a nationwide constituency and has been concerned for several years with extant erosion at the fort. The CHS served as the focal point for updates and discussions on cultural resources issues. Periodic meetings were held with the director and board of CHS. Additionally, monthly updates were provided on relevant engineering tasks, project impacts and proposed mitigation.

11.1.6.4 Others

Modification of the channel is of interest and concern to those with property adjacent to the channel.

A meeting was held in November 1997 with the major property owners in the harbor. A full briefing on project alternatives being considered, engineering work and schedule was provided. There are also a wide range of private environmental groups, other non-government organizations and private individuals who wished to understand the study, the process and express concerns about certain aspects of the project. To communicate as effectively as possible with these audiences, special sessions were arranged.

Coordination with industrial and navigation interests in the harbor was undertaken via existing groups including the Savannah Maritime Committee, Savannah Harbor Group (Chamber of Commerce), and Savannah Harbor Committee. Both the city and the county have great interest in all developments at the port and periodic briefings were given to appropriate officials.

11.2. Review Of Feasibility Report And Tier I EIS

Throughout the feasibility study, numerous meetings were held of the Technical Advisory Group, Natural Resources Advisory Group, and special meetings between study participants on specialized issues. A critical meeting was held on 18-19 February 1998 in Savannah, Georgia, to discuss the Section 203 study. Representatives from Headquarters, U.S. Army Corps of Engineers (CECW), South Atlantic Division, Savannah District, Georgia Ports Authority (GPA) and their study consultants, and key resource agencies reviewed the preliminary drafts of the Tier I Environmental Impact Statement (EIS), Engineering Appendix, Economic Appendix, and Real Estate

Appendix. At the time of the meeting, the draft main Feasibility Report had not been written.

There were relatively minor comments and discussion of the real estate, engineering, and economic appendices, which were addressed in a summary of Washington Level Review Center Comments. The preliminary draft EIS, including initial water quality modeling results, indicated a harbor expansion project would likely result in the following environmental and cultural resources impacts:

- Salinity increases upstream
- Dissolved oxygen impacts
- Impacts to Old Fort Jackson
- Impacts to CSS Georgia

Proposed cultural resources mitigation plans included protection of a portion of Old Fort Jackson and recovery of the CSS Georgia. A definitive environmental mitigation plan was not presented at the meeting and was not included in the preliminary draft EIS because additional studies and water quality modeling were underway to define spatial and quantitative impacts of salinity and dissolved oxygen in the Savannah estuary. U.S. Fish and Wildlife Service (USFWS) representatives expressed strong concern that the draft documents appeared to indicate there would be no significant environmental impacts associated with a harbor expansion project when the actual impacts had not yet been determined. The resource agencies agreed to provide comments on the draft documents, particularly the water quality model and preliminary draft EIS.

It was agreed that when the draft Feasibility Report was prepared, it would include a proposed environmental mitigation plan. The supporting documents plus the Tier I EIS would be revised to reflect additional environmental information obtained, a further evaluation of potential environmental impacts, and a preliminary mitigation plan.

On 30 March 1998, representatives of the Georgia Ports Authority and their consultants, Savannah District, USFWS, and Georgia Department of Natural Resources (GADNR) met to review an initial environmental mitigation plan which addressed four major issues:

- Shortnose sturgeon
- Freshwater marsh
- Saltwater wetlands
- Striped bass habitat

This mitigation plan is essentially the same plan as presented in this Feasibility Report for the Recommended Plan. The parties agreed to some additional water quality modeling and studies to be conducted during the remainder of the feasibility study and the engineering and design phase to refine the details of the mitigation plan. USFWS stated that their overriding concern is protection of the Savannah National Wildlife Refuge.

Based upon subsequent discussions, USFWS remains concerned that the available information is insufficient to determine an appropriate mitigation plan, including possible unintended adverse impacts of some of the mitigation plan features. Additional coordination continues toward resolution of these concerns. USFWS indicated they would provide their views and recommendations when the draft Feasibility Report and draft Final Tier I EIS are released for public review and comment.

The preliminary draft EIS also concluded there is a possibility that a harbor expansion project might result in elevated chloride levels at the city of Savannah water intake on Abercorn Creek. Subsequent to discussions with the City, GPA agreed that the feasibility study would include specific investigations to determine if a harbor deepening project would likely result in an increase in chloride levels at the water intake. If it is determined that such impacts are clearly likely to occur as a result of the project, the harbor deepening project will include, as a project cost, appropriate measures to address those impacts. The City indicated the most extreme, and costly, measure would be relocation of the intake at an estimated cost of approximately $25,000,000.

For the draft Feasibility Report and draft Final Tier I EIS, it was decided to include the $25,000,000 cost of relocating the water intake as a preliminary, cost shared, project cost. However, unless the subsequent investigations determine there is a clear relationship of likely impacts resulting from a harbor deepening project, there would be no basis to fund and implement any corrective measures. Alternatively, if direct impacts are likely to result, other less costly or more appropriate corrective measures may be taken.

The report and Final Tier I EIS were also made available to all known private citizens, organizations, and others who have an interest in Savannah Harbor and proposed harbor improvements.

The report and Final Tier I EIS were also made available to all known private citizens, organizations, and others who have an interest in Savannah Harbor and proposed harbor improvements.

12. RECOMMENDATIONS

The Georgia Ports Authority has conducted this Section 203 feasibility study to determine if harbor improvements are justified at the Port of Savannah, Georgia. The U.S. Army Corps of Engineers, Savannah District, has provided technical assistance and review of study documents to ensure compliance with applicable Federal regulations, standards, and criteria, including full compliance with the National Environmental Policy Act (NEPA).

The Georgia Ports Authority has given full consideration to all significant aspects of this study in the overall public interest, including engineering and economic feasibility, as well as social and environmental effects. It is recommended that the Savannah Harbor Navigation Project be modified as described in the Recommended Plan in this report and summarized below:

- Deepen the inner harbor (Stations 0+000 to 103+000) to a project depth of –48 feet mean low water (MLW).
- Deepen the entrance channel (Stations 0+000 to –14+000B) to a project depth of –48 feet MLW.
- Deepen the entrance channel (Stations –14+000B to –85+000B) to a project depth of –50 feet MLW.
- Construct 10 wideners in the inner harbor and 2 in the entrance channel.
- Enlarge the Kings Island Turning Basin to 1,676 feet and dredge to -50 feet mean low water.
- Provide recommended dredged material disposal area improvements.
- Implement the recommended Cultural Resources Mitigation Plan.
- Implement the recommended Natural Resources Mitigation Plan.
- Implement the recommended Striped Bass Impact Avoidance Plan.

Due to the complexity and uncertainties of the environmental issues in the Savannah River estuary and imprecise potential impacts from a harbor deepening project, additional environmental studies including water quality modeling will be conducted during Continuing Engineering and Design. The results of these additional studies might result in a supplemental Environmental Impact Statement detailing the specific mitigation plan to be enacted during construction.

The Recommended Plan has a total project cost of $228,517,000 and equivalent annual cost of $17,12,535. The project would produce estimated annual benefits of $52,742,579, which results in a benefit/cost ratio of 2.94 and $34,817,044 in net benefits.

Using applicable Federal guidelines for cost sharing of navigation projects, the Federal share would be $143,061,195. The non-Federal sponsor, Georgia Ports Authority would be required to provide $85,455,805 cash plus all lands, easements, rights of way, relocations, and dredged material disposal sites.

12.1. Items of Local Cooperation

12.1.1. Compliance with Items of Local Cooperation

The Georgia Ports Authority, as local sponsor, will comply with items of local cooperation.

12.1.2. Items of Local Cooperation to be Provided Prior to Construction

Prior to commencement of construction, an agreement will be executed between the Georgia Ports Authority and the Government that provides for the following (as appropriate):

- Agreement to the provision, during the period of construction, of a cash contribution equal to the following percentages of the total cost of construction of the general navigation features (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, or maintenance and for which a contract for the facility construction or improvement was not awarded on or before October 12, 1996):
    - 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet
    - 25 percent of the costs attributable to dredging to a depth not in excess of 20 feet but not in excess of 45 feet
    - 50 percent of the costs attributable to dredging to a depth in excess of 45 feet but not in excess of 50 feet;
- Agreement to payment with interest, over a period not to exceed 30 years following completion of the period of construction of the project, of an amount up to an additional 10 percent of the total cost of construction of general navigation features. The value of lands, easements, rights-of-way, and relocations provided by the local sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the local sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the general navigation features;
- Agreement to the provision of all lands, easements, and rights-of-way, and performance or assurance of the performance of all relocations determined by the

Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features (including all lands, easements, and right-of-way, and relocations necessary for dredged material disposal facilities) and the local service facilities;

- Agreement to the provision, operation, maintenance, repair, replacement, and rehabilitation, at its own expense, the local service facilities in a manner compatible with the project authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;
- Agreement to the accomplishment all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;
- Agreement to the granting to the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the local sponsor owns or controls for access to the general navigation features for the purpose of inspection, and, if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the general navigation features;
- Agreement to hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterment, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;
- Agreement to keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreement to State and local governments at 32 CFR, Section 33.20;

- Agreement to perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the local sponsor with prior specific written direction, in which case the local sponsor shall perform such investigations in accordance with such written direction;
- Agreement to assume complete financial responsibility, as between the Federal Government and the local sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features;
- Agreement to the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;
- Agreement to comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features, and inform all persons of applicable benefits, policies, and procedures in connection with said act;
- Agreement to comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army.
- Agreement to provide a cash contribution equal to the local cost share of the project total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of 1 percent of the total amount authorized to be appropriated for commercial navigation;

- Agreement to not use Federal funds to meet the local sponsor share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute; and
- Agreement to provide 50 percent of the excess cost of operation and maintenance of the project over that cost which the Secretary determines would be incurred for operation and maintenance if the project had a depth of 45 feet.
- Agreement to perform or assure performance of all relocations or alterations of utilities, and make necessary arrangements to ensure that one half of utility relocations or alterations determined to be necessary for construction, operation, or maintenance of the project is borne by the local sponsor and one half is borne by the utility owner.

_____ _____

Date

DOUGLAS J. MARCHAND
Executive Director
Georgia Ports Authority

13. ACRONYMS

ASA (CW)	**Assistant Secretary of the Army for Civil Works**
CB	**Container Berth**
CED	**Continuing Engineering and Design**
CEDEP	**Cost Engineering Dredge Estimating Program**
DMMP	**Dredged Material Management Plan**
EIS	**Environmental Impact Statement**
EQ	**Environmental Quality**
ER	**Engineering Regulation**
GADOT	**Georgia Department of Transportation**
GNF	**General Navigation Features**
GPA	**Georgia Ports Authority**

HPMDR	Historic Preservation Mitigation and Data Recovery
HTRW	Hazardous, Toxic, and Radioactive Wastes
IDC	Interest during Construction
ITR	Independent Technical Review
LERRs	Lands, Easements, Rights of Way, Relocations, and Disposal Areas
LPP	Locally Preferred Plan
MCACES	Micro Computer Aided Cost Engineering System
MLW	Mean Low Water
NED	National Economic Development
NEPA	National Environmental Policy Act
NRAG	Natural Resources Advisory Group
OSE	Other Social Effects
PED	Preconstruction Engineering and Design
PMP	Project Management Plan
RED	Regional Economic Development
RM	River Mile
S&A	Supervision and Administration
SCCC	South Carolina Coastal Council
TAG	Technical Advisory Group
TEU	Ton Equivalent Unit

14. INDEX

15. ATTACHMENT A TABLES

15.1. Table 13-1 Final Alternatives, Total Project Costs

ITEM	Contingency (%)	ALTERNATIVE				
		45 ft.	46 ft.	47 ft.	48 ft.	50 ft.
Dredging	25	$66,004,600	$77,915,400	$85,160,300	$96,722,100	$136,058,700
Mobilization	25	$2,956,500	$3,120,800	$3,367,100	$3,367,100	$5,017,500
Debris Removal	25	$2,278,805	$2,278,805	$2,278,805	$2,278,805	$2,278,805
Disposal Area Improvements	25	$10,927,500	$10,975,000	$11,431,300	$11,863,800	$13,784,900
Aids to Navigtion		$694,625	$772,125	$810,875	$810,875	$849,625
Dredging non-Federal Berth	25	$277,000	$334,000	$389,000	$454,000	$530,000
Continuing Engineering & Design	15	$8,400,000	$8,400,000	$8,400,000	$8,400,000	$8,400,000
Supervision & Administration	15	$3,844,000	$3,844,000	$3,844,000	$3,844,000	$3,844,000
Lands, Easements, Relocations & Rights of Way	25	$2,185,300	$2,185,300	$2,185,300	$2,185,300	$2,185,300
Environmental Mitigation		$9,612,480	$9,612,480	$9,612,480	$9,612,480	$9,612,480
Chloride Mitigation (if reqd)		$46,000,000	$46,000,000	$46,000,000	$46,000,000	$46,000,000
Dissolved Oxygen Mitigation		$24,000,000	$24,000,000	$24,000,000	$24,000,000	$24,000,000
Subtotal		**$177,180,810**	**$189,437,910**	**$197,479,160**	**$209,538,460**	**$252,561,310**
Project Costs Including Historic Preservation Mitigation & Data Recovery						
Old Fort Jackson Mitigation	25	$1,264,800	$1,264,800	$1,264,800	$1,264,800	$1,264,800
CSS Georgia Mitigation	35	$13,083,525	$13,083,525	$13,083,525	$13,083,525	$13,083,525
Total Project Costs		**$191,529,135**	**$203,786,235**	**$211,827,485**	**$223,886,785**	**$266,909,635**

Note:

- Costs are rounded to nearest $1,000
- Total costs do not include Interest during Construction and are not escalated to reflect inflation
- Historic Preservation Mitigation & Data Recovery costs are not used in the benefit/cost analysis
- Source: engineering Appendix

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15.2. Table 13-2 Final Alternatives, Economic Cost

* Excluding Historic Preservation Mitigation & Data Recovery costs

ANNUAL BENEFITS AND COSTS	45 ft.	46 ft.	47 ft.	48 ft.	50 ft.
Construction:					
Start	Oct-01	Oct-01	Oct-01	Oct-01	Oct-01
Duration	23 months	23 months	25 months	30 months	30 months
Total Project Costs*	$177,180,810	$189,437,910	$197,479,160	$209,538,460	$252,561,310
Interest During Construction	$11,697,352	$12,506,557	$14,274,060	$18,472,156	$22,264,896
Total Economic Cost including IDC	$188,878,162	$201,944,467	$211,753,220	$228,010,616	$274,826,206
Annual Project Cost	**$13,902,774**	**$14,864,547**	**$15,586,540**	**$16,783,200**	**$20,229,160**

15.3. Table 13-3 Final Alternatives, Benefit/Cost Ratio

ANNUAL BENEFITS AND COSTS	45 ft.	46 ft.	47 ft.	48 ft.	50 ft.
Annual Project Cost*	$13,902,774	$14,864,547	$15,586,540	$16,783,200	$20,229,160
Annual Costs for NED Determination:					
Annual O&M Differential Maintenance	$27,000	$102,000	$141,000	$149,000	$171,000
Annual DO System Maintenance	$650,000	$650,000	$650,000	$650,000	$650,000
Adjusted Annual Project Cost	$14,579,774	$15,616,547	$16,377,540	$17,582,200	$21,050,160
Annual Benefits	$34,145,990	$43,869,133	$48,102,967	$52,742,579	$55,615,616
Benefit/Cost Ratio	**2.34**	**2.81**	**2.94**	**3.00**	**2.64**
Net Benefits	**$19,566,216**	**$28,252,586**	**$31,725,427**	**$35,160,379**	**$34,565,456**

Note:

* Excluding Historic Preservation Mitigation & Data Recovery costs

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15.4. Table 13-4 Total First Cost of 45 & 48 ft. Projects

ITEM	45 ft.	48 ft.
General Navigation Features (GNF)		
(12) Dredging	$66,004,600	$96,722,100
(12) Mobilization	$2,956,500	$3,367,100
(12) Debris Removal	$2,278,805	$2,278,805
(12) Disposal Area Improvements	$10,927,500	$11,863,800
(30) Continuing Engineering & Design	$8,400,000	$8,400,000
(31) Supervision & Administration	$3,844,000	$3,844,000
Subtotal GNF	**$94,411,405**	**$126,475,805**
Lands, Easements, Relocations & Rights of Way (LERR)		
(01) Acquisition	$2,051,300	$2,051,300
(01) Administration	$134,000	$134,000
Subtotal	**$2,185,300**	**$2,185,300**
(12) Aids to Navigation	$694,625	$810,875
(12) Dredge Non-Federal Berth	$277,000	$454,000
(06) Environmental Mitigation	$9,612,480	$9,612,480
(06) Chloride Mitigation (if reqd)	$46,000,000	$46,000,000
(06) Dissolved Oxygen Mitigation	$24,000,000	$24,000,000
Subtotal	$80,584,105	$80,877,355
Subtotal (Federal Appropriation)	**$177,180,810**	**$209,538,460**
Historic Preservation Mitigation & Data Recovery (HPMDR)		
(18) Old Fort Jackson	$1,264,800	$1,264,800
(18) CSS GEORGIA	$13,083,525	$13,083,525
Subtotal HPMDR	**$14,348,325**	**$14,348,325**
Total	**$191,529,135**	**$223,886,785**

15.5. Table 13-5 Cost Apportionment of 45 ft. Project

	45 FT PROJECT		
	TOTAL COST	FEDERAL COST	NON FEDERAL COST
General Navigation Features (GNF)			
Dredging	$66,004,600	$49,503,450	$16,501,150
Mobilization	$2,956,500	$2,217,375	$739,125
Debris Removal	$2,278,805	$1,709,104	$569,701
Disposal Area Improvements	$10,927,500	$5,463,750	$5,463,750
Continuing Engineering & Design	$8,400,000	$4,200,000	$4,200,000
Supervision & Administration	$3,844,000	$1,922,000	$1,922,000
Subtotal GNF	**$94,411,405**	**$70,808,554**	**$23,602,851**
Lands, Easements, Relocations & Rights of Way (LERR)			
Acquisition (100% non Federal)	$2,051,300	$0	$2,051,300
Administration (75% Federal/25% non-Federal)	$134,000	$100,500	$33,500
Subtotal LERR	**$2,185,300**	**$100,500**	**$2,084,800**
Aids to Navigation (100% Federal)	**$694,625**	**$694,625**	**$0**
Dredge non-Federal Berth (100% non Federal)	**$277,000**	**$0**	**$277,000**
Natural Resources Mitigation & Striped Bass Impact Avoidance Plan (75% Federal/25% non Federal)	$9,612,480	$7,209,360	$2,403,120
Chloride Mitigation (if reqd)	$46,000,000	$34,500,000	$11,500,000
Dissolved Oxygen Mitigation	$24,000,000	$18,000,000	$6,000,000
Subtotal (Federal Appropriation)	**$177,180,810**	**$131,313,039**	**$45,867,771**
Historic Preservation Mitigation & Data Recovery (HPMDR)			
Old Fort Jackson Mitigation	$1,264,800		
CSS Georgia Mitigation	$13,083,525		
One Percent of Federal Appropriations	$944,114	$944,114	$0
Remaining HPMDR @ 75/25 %	$13,404,211	$10,053,158	$3,351,053
Subtotal HPMDR	**$14,348,325**	**$10,997,272**	**$3,351,053**
Additional Funding Requirements			
10 Percent of Total Federal Appropriation		($17,718,081)	$17,718,081
10 Percent of HPMDR Above One Percent		($1,340,421)	$1,340,421
Adjustment for LERR		$2,051,300	($2,051,300)
Net Additional Funding Requirements		**($17,007,202)**	**$17,007,202**
Total Project First Cost Requirements	**$191,529,135**	**$125,303,109**	**$66,226,026**

- Note: The value of lands, easements, rights of way and relocations provided are credited toward the 10 percent additional non-Federal cost share to be paid in cash over a period not to exceed 30 years.
-

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15.6. Table 13-6 Differential costs and Cost Apportionment, 45 to 48 ft. Project

ITEM	45 ft.TOTAL COST	45 ft. FEDERAL COST	45 ft. NON-FEDERAL COST	48 ft. TOTAL COST	DIFFERENTIAL 45 - 48 ft.	48 ft. FEDERAL COST	48 ft. NON-FEDERAL COST
General Navigation Features (GNF)							
Dredging	$66,004,600	$49,503,450	$16,501,150	$96,722,100	$30,717,500		
Mobilization	$2,956,500	$2,217,375	$739,125	$3,367,100	$410,600		
Debris Removal	$2,278,805	$1,709,104	$569,701	$2,278,805	$0		
Disposal Area Improvements	$10,927,500	$5,463,750	$5,463,750	$11,863,800	$936,300		
Continuing Engineering & Design	$8,400,000	$4,200,000	$4,200,000	$8,400,000	$0		
Supervision & Administration	$3,844,000	$1,922,000	$1,922,000	$3,844,000	$0		
Subtotal GNF	**$94,411,405**	**$70,808,554**	**$23,602,851**	**$126,475,805**	**$32,064,400**	**$86,840,754**	**$39,635,051**
Lands, Easements, Relocations & Rights of Way (LERR)							
Acquisition (100% non Federal)	$2,051,300	$0	$2,051,300	$2,051,300			
Administration (75% Federal/25% non-Federal)	$134,000	$100,500	$33,500	$134,000			
Subtotal LERR	**$2,185,300**	**$100,500**	**$2,084,800**	**$2,185,300**	**$0**	**$100,500**	**$2,084,800**
Aids to Navigation (100% Federal)	**$694,625**	**$694,625**	**$0**	**$810,875**	**$116,250**	**$810,875**	**$0**
Dredge non-Federal Berth (100% non Federal)	**$277,000**	**$0**	**$277,000**	**$454,000**	**$177,000**	**$0**	**$454,000**
Natural Resources Mitigation & Striped Bass Impact Avoidance Plan	$9,612,480	$7,209,360	$2,403,120	$9,612,480	$0		
Chloride Mitigation (if req.)	$46,000,000	$34,500,000	$11,500,000	$46,000,000	$0		
Dissolved Oxygen Mitigation	$24,000,000	$18,000,000	$6,000,000	$24,000,000	$0		
Subtotal (Federal Appropriation)	**$177,180,810**	**$131,313,039**	**$45,867,771**	**$209,538,460**	**$32,357,650**	**$147,491,864**	**$62,046,596**
Historic Preservation Mitigation & Data Recovery (HPMDR)							
Old Fort Jackson Mitigation	$1,264,800			$1,264,800	$0		
CSS Georgia Mitigation	$13,083,525			$13,083,525	$0		
One Percent of Federal Appropriations	$944,114	$944,114	$0				
Remaining HPMDR @ 75/25 %	$13,404,211	$10,053,158	$3,351,053				
Subtotal HPMDR	**$14,348,325**	**$10,997,272**	**$3,351,053**	**$14,348,325**	**$0**	**$10,997,272**	**$3,351,053**
Additional Funding Requirements							
10 Percent of Total Federal Appropriation		($17,718,081)	$17,718,081				
10 Percent of HPMDR Above One Percent		($1,340,421)	$1,340,421				
Adjustment for LERR		$2,051,300	($2,051,300)				
Net Additional Funding Requirements		**($17,007,202)**	**$17,007,202**		**$0**	**($17,007,202)**	**$17,007,202**
Total	**$191,529,135**	**$125,303,109**	**$66,226,026**	**$223,886,785**	**$32,357,650**	**$141,481,934**	**$82,404,851**

16. ATTACHMENT B, EIS PROVISION FOR SAVANNAH HARBOR EXPANSION

16.1. Provision For the Tier I EIS, ROD and Report of the Chief of Engineers

Subject to authorization in the Water Resources Development Act of 1998, additional environmental scientific analyses are required during the design phase of the project in order to provide information necessary for the natural resource agencies, the City of Savannah, and affected manufacturing interests to complete their respective evaluations of potential impacts resulting from proposed expansion of the Savannah Harbor channel up to a depth of 48 feet and to participate fully in the development of modifications to the proposed mitigation plan in conjunction with identification of the appropriate channel depth. The additional scientific analyses and the resulting modifications to the mitigation plan will be subject to a Tier II Environmental Impact Statement.

This Tier I Environmental Impact Statement supporting the potential engineering and economic feasibility of a channel up to 48 feet deep requires a Tier II environmental analysis including a Tier II Environmental Impact Statement which will, through appropriate scientific analysis, identify the depth which results in an acceptable level of environmental impacts, and then identifies mitigation necessary to avoid, minimize, or compensate for those impacts.

The scientific analyses will be developed by a Stakeholders Evaluation Group (SEG) comprised of the Georgia Ports Authority, the Army Corps of Engineers, the U. S. Fish and Wildlife Service, the U. S. National Marine Fisheries Service, the Environmental Protection Agency, the U. S. Department of Transportation, the Georgia Department of Natural Resources, the South Carolina Department of Natural Resources, the South Carolina Department of Health and Environmental Control, the City of Savannah, and the Savannah Manufacturers Council. Other interested parties will be welcome to participate in the evaluation process as well. The SEG will identify all potential environmental impacts at each incremental depth from 42 feet to and including 48 feet. If channel deepening is environmental feasible, the SEG will recommend whether and to what extent to modify the mitigation plan to fully address salinity impacts on the Savannah National Wildlife Refuge, salinity and dissolved oxygen impacts on the endangered shortnose sturgeon, salinity and other impacts on striped bass spawning and nursery habitat, chloride impacts on the city's water intake, and dissolved oxygen impacts on existing manufacturing discharges. The SEG recommendation will define the scope of scientific analysis and environmental evaluations for the Tier II EIS, including the need to establish along term monitoring program to continue scientific analyses, evaluate the efficacy of the mitigation plan, and identify further adjustments to the mitigation plan during operation of the project. A flow chart depicting the SEG process is attached.

If the SEG is unable to develop a consensus on the scope of additional scientific analyses within a period of six months from the date of project authorization, the group will furnish a report to the Secretary of the Army, the Secretary of the Interior, the Secretary of Commerce, the Administrator of the Environmental Protection Agency, Commissioner of the Georgia Department of Natural Resources, the Director of the South Carolina Department of Natural Resources and the Commissioner of the South Carolina Department of Health and Environmental Control, describing the unresolved issues and the respective stakeholders' views on the issues. Neither the Secretary of the Army nor the Georgia Ports Authority will proceed with further work on the scientific analyses for development of the mitigation plan or complete selection of the optimum channel depth until the respective department heads concur in an appropriate scope of work for the additional scientific analyses.

The final channel deepening plan and its associated mitigation plan will support and be consistent with, and in no way preclude, any proposed restoration of degraded Back River striped bass spawning habitats from previous harbor improvement projects. Back River restoration measures will be identified through an ongoing Georgia Department of Natural Resources/Corps of Engineers Section 1135 feasibility study partnership.

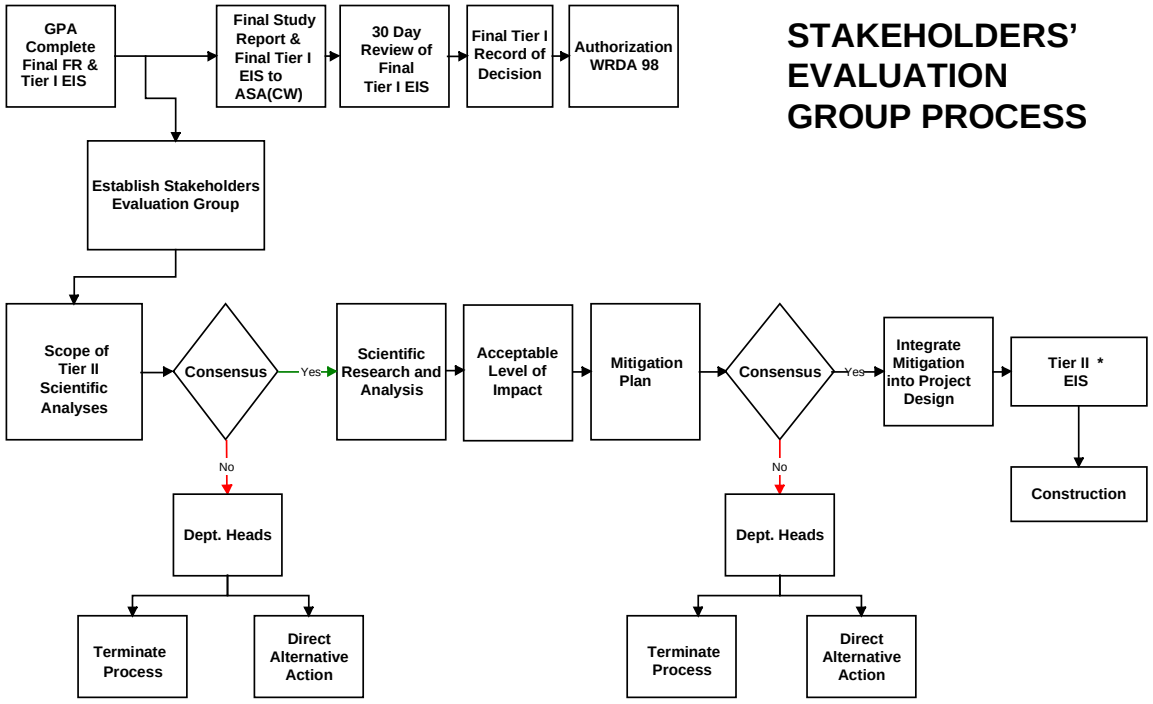
The deepening alternatives and the associated mitigation plans will be evaluated in the Tier II EIS which will be subject to further compliance with the National Environmental Policy Act, the Fish and Wildlife Coordination Act, Endangered Species Act, Coastal Zone Management Act, the Clean Water Act, and the Ocean Dumping Act. The Tier II EIS will serve as a decision making tool for the alternatives and the mitigation plan.

If the stakeholders evaluation group determines that a final channel deepening plan, including the mitigation plan, cannot be reached in a reasonable time, the group will furnish a report to the Secretary of the Army, the Secretary of the Interior, the Secretary of Commerce, the Administrator of the Environmental Protection Agency, the Commissioner of the Georgia Department of Natural Resources, the Director of the South Carolina Department of Natural Resources and the Commissioner of the South Carolina Department of Health and Environmental Control, describing the unresolved issues and the respective stakeholders' views on the issues. Neither the Secretary of the Army nor the Georgia Ports Authority will proceed with the final design or construction of the project until the respective department heads concur in an appropriate implementation plan and mitigation plan.

Implementation of the selected mitigation plan will be concurrent with and an integral part of execution of the project.

Notwithstanding a consensus, each individual stakeholder will retain and reserve its individual rights and options to oppose the resultant project.

16.2. Stakeholders Evaluation Group Process



**This step includes publication of a draft Tier II EIS with a 45 day public comment period, revisions as necessary, and publication of a final Tier II EIS with an additional 30 day public comment period.*